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Complete HANDYMAN ENCYCLOPEDIA

10

HOME OWNERSHIP
LASER

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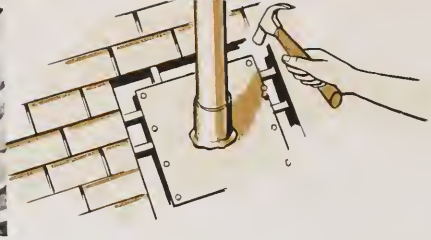
Complete Handyman do-it-yourself Encyclopedia



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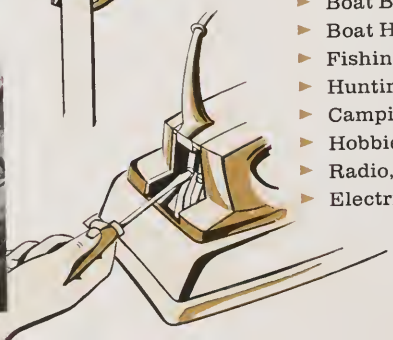

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Complete Handyman yourself Encyclopedia

A COMPILATION OF NEW AND PREVIOUSLY PUBLISHED SPECIAL INTEREST PROJECTS AND MANUALS FOR THE REPAIR AND CARE OF HOMES, AUTO, APPLIANCES, HOBBY EQUIPMENT.

by the editors of

Science & Mechanics

10

HOME OWNERSHIP

LASER

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Costs Versus Livability in Building a Home

For any home you build, you must determine and meet certain minimum living needs, but once you go beyond the minimum, costs per square foot will drop considerably

ONCE YOU HAVE determined your requirements in building a home (three bedrooms, four bedrooms, two bedrooms now with one or two more added later), and other problems peculiar to your own family group, there are only three cost factors to determine before you reach the plan purchase stage:

1. Size of the house in square (or cubic) feet.
2. Number of baths and lavatories.
3. Amount of livability packed into each square foot.

At this time, nothing can be done about materials, labor, equipment or maintenance, all of which affect costs. It's too early a stage to consider them. Actually, you may wish to make many additions, omissions or substitutions—as your budget permits or requires.

Later on, after you have selected your plan and purchased the working drawings, specifications and mill list, you can consider any changes you may want to make from the original plan. These should be discussed with your builder.

However, once the plan is selected, you cannot very well decrease the size of a building. Neither is it economical to provide the space for a second bath intended to be finished at a later date (except in the 1½-story, expansion attic type). Most important of all is the cost-saving on the amount of livability packed into a house.

Size of the house. The number of square feet of floor space in a home design (or cubic feet in the house) is a fairly good indication of its cost in relation to another house. Discretion must be exercised against going overboard on size because of the cost. However, it is not wise to go to the minimum house either, as described in the next paragraph, unless required by unusual circumstances. To do so, precludes the balance between cost and desirability that is necessary to protect your resale value. Even though you may have no intention of a resale at the time of planning your new home, it is always wise to keep this possibility in mind. It will help you obtain a better mortgage, too.

To give you an idea of what constitutes minimum planning, consider these minimum standards established by the Federal Housing Administration:

Living unit with three bedrooms total minimum square footage 280, with minimum bedroom of 80 square feet.

Combined living-dining-kitchen area: 250 square feet (about 13 x 20 feet).

"homescaping" with bricks: see brickwork
home security: see security, home

Closets: three feet wide, two feet deep. Storage area for basementless house: 200 cubic feet plus 75 cubic feet per bedroom (about 6 x 9 feet area with eight foot ceiling for a three bedroom house); this is in addition to required closets and kitchen storage.

Adding all of these minimums together, plus minimum bathroom, hall space to bedrooms and bath and the area taken up by partitions and walls (approximately 12 per cent of the total) will bring the total area of the minimum house to about 700 square feet.

Now that you have a good idea of how minimum a house can be, you can better evaluate its relationship to the house of your choice. Any house with these room sizes is far from desirable, representing only what might be considered the bare necessities of living.

It does, however, have a bathroom with tub, toilet and lavatory; it does have a kitchen sink, door to the bath and each bedroom; it does have electrical, and possibly gas, connections, also a water line and sewer line, cesspool or septic tank. Its lot had to be surveyed, plans purchased and filed, legal work performed. All of these represent costs common to any house, regardless of size.

If you assume that, with the above items included, the 700-square foot house cost around $7,000 to build, that cost would be at a rate approximating $10 per square foot. Of course, this is an arbitrary figure, used here for illustrative purposes only.

Enlarging the bedrooms, living room and dining area by another 700-square feet would not add any more bathrooms, doors, electric, gas or water intake lines, or increase the cost of a survey, legal work or plans. Moreover, wall area, heating lines, kitchen equipment, etc., would not likely increase in proportion to the square foot area gained. Neither would the cost of carpentry, plumbing, electrical work, painting, etc., be doubled. Consequently, this added section becomes an "inexpensive" area which would cost little more than half that of the original 700 square feet. Thus, it might be as low as $6 per square foot, with equal quality of construction and materials.

Accordingly, when the $7,000 cost of the first 700 square feet is added to the $4,200 cost of the second 700 square feet you have a house twice the size of the minimum unit for $11,200. Cost of the larger house is about $8 per square foot, which is $2 per square foot less than cost of the minimum house. Surely, the larger house cost $4,200 more, but look at the great increase in dollar value.

Summing up, the small house is expensive in square foot cost. As it increases in size, total dollar cost goes up but not at the same rate—the square foot cost decreases, assuming that basics such as baths, material choice and kitchen equipment remain unchanged.

Number of bathrooms. In the past ten years, housing trends have been influenced by the two terrific "cost adders." The biggest "offender" is the increased number of bathrooms and lavatories called for in even the medium-sided houses.

The second "offender" is the great increase in the amount of kitchen and laundry equipment. As a basic cost factor, let's consider only the bathroom situation, since kitchen-laundry equipment can be changed, added to or subtracted from, even planned for future changes, without materially affecting plan layout.

It is a different story where bathrooms are concerned. For here the room *must* be provided and the waste and supply lines should be installed during original construction. If this is done, the relatively small additional cost of fixtures, accessories and finishing hardly warrants any delay in completing the extra bathrooms. An exception is the expansion attic—one place where

waste and supply lines can be installed, capped and left until needed.

If bathrooms (or a bathroom and lavatory) are placed back-to-back, the cost will be somewhat less expensive for the plumbing. However, to accomplish this in some cases might require from 10 to 30 additional square feet of hall and waste space. Even at the low cost of $6 per square foot, this would add an expense of $60 to $180, which could well offset the saving of a back-to-back plumbing installation.

In addition, you should determine how much inconvenience the adjoining baths would cause your family, in comparison with the same facilities located in different parts of the house.

There is economy in placing one bath over another—a possibility in split-level, 1½-story or two-story houses—but this calls for discretion. An apparent saving of $100 in plumbing might be more than offset in square foot loss and could cause inconvenience to the occupants during the life of the house.

Before deciding on the amount of bathroom facilities, it is most important to judge what your family truly needs—without going overboard. Remember that bathrooms, with their fixtures, fittings, tile, waste and supply lines, comprise just about the most expensive square footage in the entire house. Nevertheless, that extra bath may be well worth it when you consider family convenience and resale value.

Amount of livability. The importance of this basic cost factor to you is so great that it should be of prime consideration in your search for a new plan. The amount of livability packed into each square foot of space depends upon that intangible which is the difference between good and bad planning. That difference offers a terrific savings potential.

We have already stressed the importance of cost per square foot of floor area and pointed out that any waste of square footage actually increases cost. Compare the plan of your choice to other plans you may have seen or homes you have been in.

Danger of a specific price. It is hard for a layman to understand why a house design cannot be priced between certain figures to give him an idea of the cost.

The variation in subcontract prices can be 100 per cent between one locality and another—some of the most active sections are "high-cost" areas—because of:

1. Building codes. Some areas have none; others have very restrictive rules insisting on certain practices and forbiding others despite general acceptance elsewhere.
2. Fluctuating cost of materials and equipment, due to availability in the local market and transportation charges.
3. Local labor wage scales, practices, productivity.
4. Quality of material and equipment you select.

Actually, the only price scale worth quoting for a house design is, for example, $15,000 to $25,000, or $20,000 to $30,000, because of the wide spread that exists nationally.

When you get right down to it, there are only two effective steps in cost hunting, regardless of how much we, or you, might wish the situation were different. After you have picked a house design, try to locate a recently built home in your community; one which has nearly the same square foot area, same number of baths, similar equipment. Your local lumber dealer, builder, real estate broker or banker can help you locate such a house. Its price will give you an approximate idea of your own cost.

For an accurate figure, however, there is no other way than to turn over your plans, specifications, lumber and mill list to a builder and get the estimate from him.

See also: ELECTRICITY; FUELS; HOME IMPROVEMENT; LUMBER; PLUMBING.

Plan room dimensions that will accommodate standard rug sizes like easy to install six- or 12-foot-wide rolls. There is no need for expensive custom fitting and this wall-to-wall carpeting allows you to substitute less expensive flooring in place of fine hardwood which you would not want to hide.

Cutting Initial Construction Costs

If that home you have always wanted still seems like a dream, here are some construction hints that can help you cut costs and make your home-owning dreams a reality

As CONSTRUCTION COSTS climb ever higher, thousands of home-hungry people either decide that home-owning is too costly for them, or they assume mortgage millstones that eventually grind out more chaff of financial despair than the zesty grain of good living. Yet every potential homeowner could find many ways to reduce the cost of a new home, and thereby keep the mortgage within reasonable limits. One way is to avoid buying more luxury than the family income can support. Another way is to plan ahead and cut construction costs without unduly sacrificing either structural quality or basic living comforts.

If you build your own home, or have it custom built by a contractor, you can exercise your cost-cutting prerogatives to the fullest extent. If you shop for a ready-made home, you must either take or leave what is offered; but even then you can save money —mainly on long-term maintenance costs —if you know a good buy from a bad one.

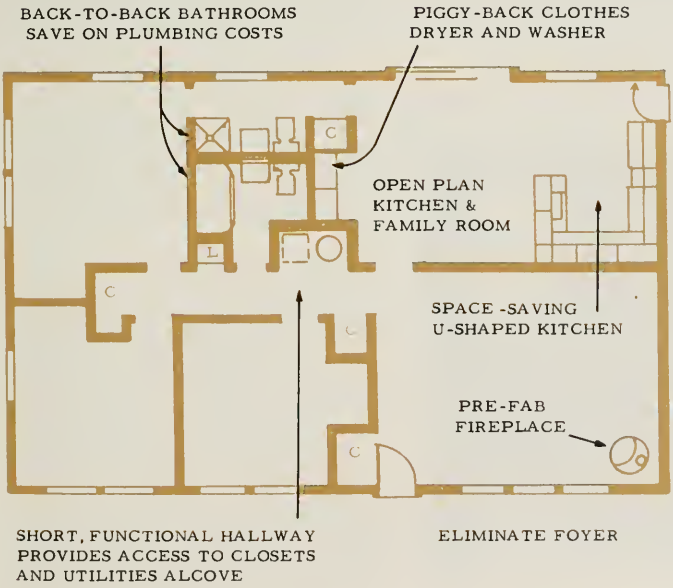
To cut costs to the bone, postpone the purchase of luxury items until you can really afford them. Remember that all those who are involved in the building and furnishing of your home stand to benefit finan-

cially each time you are cajoled into reaching for an unnecessary feature; hence there is often a very real temptation to make luxury items appear to be necessities. Resist such blandishments, but do not make the mistake of thinking that the cheapest items are always the best. Pay more when you are sure that a premium price buys quality construction that will save on maintenance costs in the years ahead.

Choosing a good site. Probably no other single factor has as much influence on the ultimate, long-term cost of building and owning your home as the lot you select. Above all, the land should be stable and provide good drainage. If the drainage is poor, you may spend a great deal of money on a basement that will be virtually unusable, or one that will require expensive waterproofing measures. Avoid lots near embankments that could erode and force you to build costly retaining walls. If you yearn for a site near a river or stream, investigate what happens when flood conditions occur—even if your tentative site is some distance from the water's edge. A periodically flooded home is a very expensive home—or it may become no home at all.

The lot you select could be too stable for your needs. Probe under the topsoil to find out how close the bedrock lies if you plan to have a full basement. Rock blasting is expensive. If you have no need of a basement, rocky terrain poses few if any problems as far as house construction is concerned.

But very rocky land could pose another problem. If the area has no public sewer lines, you may have trouble finding a suitable location for a septic system. If a septic system is necessary, have the local health


BACK-TO-BACK BATHROOMS SAVE ON PLUMBING COSTS
PIGGY-BACK CLOTHES DRYER AND WASHER
OPEN PLAN KITCHEN & FAMILY ROOM
SPACE-SAVING U-SHAPED KITCHEN
PRE-FAB FIREPLACE
SHORT, FUNCTIONAL HALLWAY PROVIDES ACCESS TO CLOSETS AND UTILITIES ALCOVE
ELIMINATE FOYER

This diagram offers an economical rectangular floor plan. No space is wasted on a foyer, and the hallway, with access to closets and utility alcove, is very functional. Back-to-back bathrooms eliminate plumbing costs and the suggested pre-fabricated fireplace minimizes the expense of a built-in one.

authorities check out the possible septic field locations for evidence of adequate absorption. Do this before you buy the lot.

Are other public utilities—gas, water and electricity—readily available? Or might you have to pay extra for long delivery lines to your home? In particular, determine the cost of digging a water pipe trench to below frost level—especially if the terrain is rocky. And remember that private roads and long driveways are expensive to build and maintain—especially in northern climes where annual snow removal costs could become very high.

Other factors to bear in mind when lot hunting include good air circulation (avoid low, closed-in areas where smog and excessive humidity could make you miserable), and good house orientation which means putting large picture windows on the south side of the house to enjoy the heating benefits of the winter sun. If your lot is heavily wooded, what will be the cost of tree removal to make room for the house? If it is a bare lot, how much will you have to spend on landscaping and tree planting? If the lot is large, can much of it be kept more or less in its natural state to reduce maintenance costs while still keeping it attractive and usable?

Unique and attractive free-standing wood burners are available in a variety of styles to enhance any living or family room.

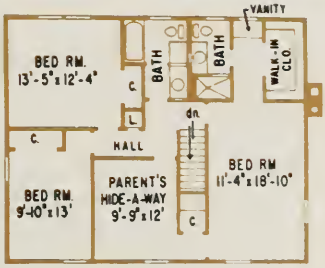
Choosing an economical house plan. Low, rambling homes are attractive, but they also are the most expensive to build because of their relatively large roof areas. To obtain the maximum living space per dollar invested, choose a two-story house having a rectangular floor plan. If a two-story home does not appeal to you consider a 1½-story home having a usable attic and a dry basement that could be used for extra living quarters. Well-drained, sloping land is ideal when a basement is to be used as a living area because large windows can be used to make it airy and cheerful.

In the long run, simple gable roofs are most economical; although shed and flat roofs are cheaper to build, they offer relatively poor drainage of rainwater and are costly to maintain.

If you do not want a basement, slab-on-grade construction may save you money. Although crawl-space construction costs more, you may be able to use the space for utilities such as water tanks, air conditioners, piping, pumps and other items that would otherwise have to go inside the house.

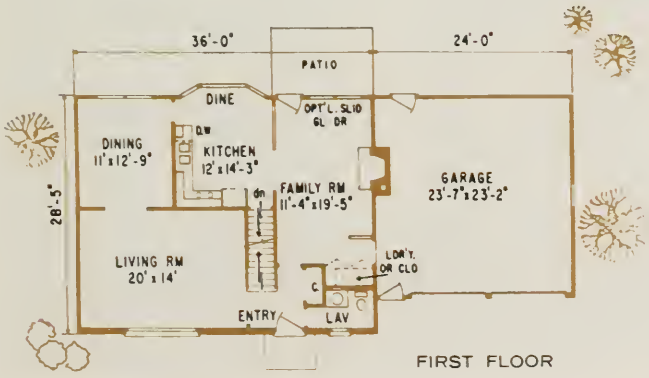
A very low-pitched roof wastes money because the attic is either unusable, or it can at best be used as a rather inconvenient storage area. Raise the roof a bit, and you have a good storage area, plus the possibility of expanding your living quarters in the future. If you know that you will eventually want to finish the attic, build in any required dormers at the outset because it will be cheaper in the long run. One wide "shed" dormer is at once more useful, and less costly, than two or three small "gable" dormers. Also rough in the plumbing for a future bathroom, and install basic electrical

For maximum living space, a two-story house is recommended. This model offers good drainage in a sloping roof and costs less to roof than a low, long ranch-style home. Plan ahead with a raised roof and dormers so attic space can easily be converted to living quarters.



SECOND FLOOR

Note the practical floor plan with front and back service entries eliminating much traffic from the main house.



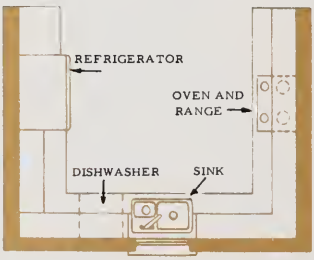
FIRST FLOOR

Wall paneling is easy to install and lends a handsome finish to any room. Prefinished wall panels may be initially expensive but a good long-term investment as you save on painting and wall-covering costs.

wiring when the home is under construction. It always costs more to add such features, than to build them in at the outset.

Money-saving interiors. Select a floor plan having the least amount of space wasted on hallways. One exception to this rule is a hallway that has some functional use other than traffic routing; for example, it might have built-in storage areas or an alcove for laundry equipment.

Open-plan construction provides more living space without any increase of the total floor area because zone activities can "bleed over" into adjoining areas. There is also a psychological advantage in that you feel less closed in, especially in a home having small rooms. However, remember that you obtain these advantages at some sacrifice of privacy, and the family that lives in an open-plan home must be attuned to togetherness-style living.



Planning a well laid out kitchen also saves expense. A small U-shaped room will operate very efficiently and cost far less than rambling luxury kitchens.

Check the room dimensions to be sure that they will accommodate standard rug and carpet sizes, so that you won't have to pay extra for custom fitting. Standard rug sizes are: 3x5, 4x6, 9x12, 8x10, 10x14 and 9x15 feet. The standard widths of carpeting are 12 and 15 feet.

The kitchen is one of the most expensive rooms in an average home. A small kitchen, if properly laid out, can be more efficient as well as less costly, than a large one that is poorly planned. A U-shaped kitchen is usually the most efficient. Try to make the best possible use of every square inch of space in the kitchen. A hot-water heater might go into an otherwise unusable corner under a counter. Perhaps a doorway can be shifted to provide better appliance arrangement. If you are really pinched for funds, install open shelves that can be closed in

later. If you want ready-made cabinets, make sure that standard size units fit properly; custom-built cabinets are very expensive. On the other hand, if you are a skilled do-it-yourselfer, there's no better way to save money than to build your own cabinets. If you are not skilled in such work, use ready-mades that fit because construction mistakes are always costly no matter who goofs.

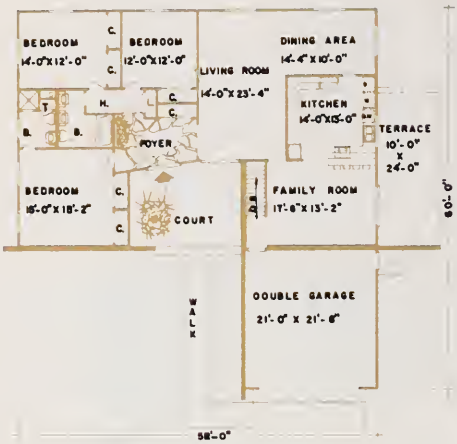
Make provision for such luxury appliances as you may want in the future. For example, proportion one cabinet area so that it will accept a dishwasher without the need of extensive counter alterations. You can save space, and money, by using a conventional range that combines the cooktop and oven in one unit. A separate wall oven is likely to be more costly unless it would go into a space that has little or no other functional use.

Always think in terms of real values. For example, if you want to save money on major appliances, put your money into practical features and avoid spending money on frills. A case in point: when buying a refrigerator, avoid cost-boosting fancy trims, special decorator door panels, and such extras as built-in water coolers. Get the best equipment you can afford that does the one really vital job—keeping your food from spoiling.

Bathrooms are also expensive, but you can cut costs dramatically by placing two bathrooms back-to-back, or by placing one above the other in a two-story home. Professional bathroom tiling is costly, so consider doing the walls yourself, using any of the large variety of plastic bathroom wall covering materials that can be applied with adhesives. Almost anyone can do a creditable job in this area by following a manufacturer's instructions to the letter.

Put your laundry in the basement, if

Adhesive-backed tiles in a variety of colors and textures make the job of installing your own vinyl flooring easy and lend a handsome finish to almost any room.



Open-plan construction provides more living space without increasing the floor area. Note how rooms "bleed over" into adjoining areas. This can lend a sense of spaciousness even to smaller floor plans.

possible, because floor space in the basement costs less than the same space on the main living level. If you have no basement, and space is at a premium, consider laundry units that permit placing the dryer on top of the washer. In warm areas you can even put the laundry equipment in the garage.

Economical storage. No homeowner ever has enough storage space, and the problem is especially acute if there is no attic or basement. Avoid closets that are too deep for their intended purposes; deep closets waste space, hence they are costly. In many places you can use storage walls instead of conventional walls; these can be bought ready-made, or you can perhaps build them yourself. If you have a carport rather than a closed garage, make the outer wall a storage shed to contain tools and garden equipment.

Cutting construction materials costs. You must work closely with your building contractor and materials suppliers to select good quality materials while avoiding unnecessary costs. Compare the costs of roofing materials in terms of unit area coverage. Add the relative labor costs for installation. Then select the best for your needs, even if it means paying more than

Piggy-back clothes washer and dryer is another space saving idea. This arrangement takes up half the usual floor space and it recessed in a closet or alcove, no room area is lost.

Indoor-outdoor carpeting, ideal for kitchen, family or recreation room, is economical because it wears well and is easy to maintain. Moisture resistant, it can also be used in basements that have a tendency to be damp.

the bottom price to obtain truly durable materials.

Should you use wide or narrow shingles? Or wide or narrow siding? Compare the relative materials costs per square foot of surface covered. When comparing labor costs, remember that it takes more time to install narrow shingles or siding than the wider varieties. All things considered, prefinished plywood might turn out to be the most economical outside covering because of the speed with which it can be installed.

Wall materials that form both the exterior and interior walls are least expensive, but they may be practical only in warm areas. Concrete and cinder blocks fall into this category. Use large rather than small blocks to minimize labor costs. Use insulation board rather than sheathing where the load requirements permit, and where heavy winds are not common.

Prefinished interior wall materials are relatively expensive, but they could save money if professional workers would have to paint or otherwise finish conventional wall surfaces.

The initial cost of a good hardwood floor is fairly expensive, but it can be a good long-term investment. However, it would make no sense to install a fine wood floor and then cover it with wall-to-wall carpeting.

You can save a great deal of money by laying your own plastic floor tile in such rooms as the kitchen, family room, recreation room, and even in the living room. The job is easy if you use tiles that already have adhesive on the backs. Buy thick tile because it lasts longer. Dark tiles usually cost less than do light-colored tiles. Asphalt tile is cheapest, and suitable for most areas except the kitchen where asphalt tile should have a plastic coating. Vinyl asbestos tiles are favored for general use in low-cost housing. Both vinyl asbestos and asphalt tiles may be used in the basement. Another option is to use indoor-outdoor type carpeting; it is not cheap, but it will last a long time and is easy to maintain. Use only moisture-resistant carpeting in basements that have a tendency to be damp; do not use permanent carpeting in a basement where actual water seepage during prolonged rainy periods is a possibility.

Stick to standard size window and door frames, and to save on labor costs consider using factory-assembled window units. When choosing windows, pick those that permit the use of standard length draperies —especially if you would not sew your own. Custom-fitted draperies are very expensive. In northern climes you will save money on heating bills if your windows are properly insulated. Compare the relative costs of using double-glazed windows which require no extra storm windows, with single-glazed windows that would require extra storm protection. Include all installation costs in your calculations.

Fancy doors cost more than do plain doors, so buy plain ones to save money; there are many ways to add decorative touches to make plain outside doors look more interesting.

Basement economics. Be very sure that your basement contractor puts in adequately strong footings and that all reasonable waterproofing features are included. If the footing sags, your home will be damaged and your basement may leak. If there is any question at all about water getting into the basement, add drainage tiles at the base of the foundation before back-filling. Doing this job later may be impossible, or at the least very costly.

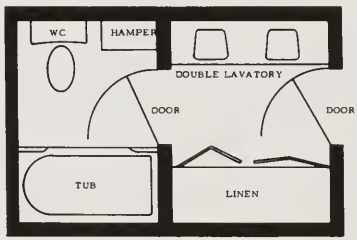
Save on heating and cooling. Should you install gas, oil or electric heating? There's no pat answer because the relative economics vary from one community to another. Investigate all possible alternatives carefully on the basis of initial equipment installation costs and the long-term fuel costs as stated in terms of usable BTU's of heat. Be warned that this can become very tricky. For example, those who wish to sell you an oil-fueled system will not mention that a lot of heat will go up the chimney. The proponents of gas and electric heating can be equally cagey about forgetting to mention some pertinent fact.

In any case, reduce your heating bill by placing large windows where they will let in the winter sun to help warm the house, that is if you live in the north. In hot areas you should do just the opposite to help keep the house cool. Leave good shade trees in place to help shade the house in the summer. Do not dash out and buy air-conditioning equipment at the outset. You may find that your location is such that you will be quite comfortable if you merely install an attic fan that can change the air in the house during the cooler night hours. Use light-colored roofing materials to help keep a house cool because dark materials absorb more solar heat.

The suggestions contained here do not cover all the cost-saving possibilities you will encounter if you are alert. The point being made is that you can save money at every step of house construction by participating knowledgeably with your building contractor and materials suppliers. But you can do that only if you make the effort to learn as much about home construction methods, and the materials used, as you can. It is a big job, of course, but it can pay sweet dividends in money saved. And there is another plus. You will enjoy your home all the more if you have actively participated in its creation. J.H.

See also: ELECTRICITY; FUELS; HOME IMPROVEMENT; LUMBER; PLUMBING.

Another cost reducing idea is the split bath. More economical than two separate bathrooms, plan can include a third door at left, giving access to a second room or hallway.



Financial Advantages of Owning a Home

A hedge against inflation, a tax advantage and a good long-term investment, owning a home can easily bring you 14 percent appreciation each year

EVER HEAR OF LIVING in a tax shelter? Well, 65% of the families in this country do. This is the percentage of American families who own their home. There are several financial advantages to owning a home. In addition to the tax advantage, it is a good long-term investment and a hedge against inflation.

Whether motivated by economic or non-economic reasons, all homeowners gain special financial benefits. For one thing, the total amount paid for real estate taxes and mortgage interest is deductible for income tax purposes. Some states even grant homestead exemptions on owner occupied homes which further reduces tax liability.

Take, for example, a man earning $15,000 a year with a wife and two children paying off a 20-year $20,000 mortgage at 7½%. With standard deductions this man will be paying 22% federal income tax on a taxable income of about $11,000. Mortgage interest for the first year will be more than $1,400. Real estate taxes may be as much as $600. Together, these two will reduce his taxable income to $9,000, saving him $440 compared to somebody in the same bracket who is paying rent.

Admittedly, as the equity grows reducing the unpaid balance, the interest will become a diminishing item in itself. But you must also assume that the man's salary is increasing over this same period placing him in a higher tax bracket. The decrease

in deductible mortgage interest is being offset by an increase in the percent income taxes coming out of his adjusted income.

Now if the yearly savings on income tax is being invested each year, the homeowner has profited in yet another way. He is drawing interest or dividends on this money.

During this same period the renter is also paying real estate taxes and mortgage interest in the form of rent payments. But these cannot be isolated as an income tax deduction as in the case of the homeowner.

As prices rise, so does the value of a home. This has been estimated to be at least 5%. Applied to an average equity, this would represent about 14% appreciation in value. As an investment, this is easily comparable to what a good stock would return.

The price of raw, underdeveloped land alone has risen about 18% per year over the last 20 years. And a house that cost $25,700 in 1966, will cost you about $31,500 today.

To translate the difference between buying and renting into actual dollars, let's continue our example: a $20,000 home with a 20-year mortgage at 7½% as compared to rent payments of 14% of a property's value. After six years the owner will be almost $5,000 ahead of the game than if he had rented. In 20 years, this difference soars to over $40,000.

In addition, money invested in a home grows in value without taxation until the home is sold. And if the money is reinvested in another home of greater value, the tax payment can be postponed until that house is finally sold—often at retirement time, when rates will be lower.

Each person's tax picture is different. But monthly mortgage payments will be the same. To compare your present monthly rent to mortgage payments, see the accompanying chart. Check with your lawyer or internal revenue office to learn what would be tax deductible.

Take the total amount that you'll be able to deduct and figure out how much you could be banking in comparison to what you're presently paying in rent. J.L.

See also: HOME IMPROVEMENT.

MONTHLY MORTGAGE PAYMENTS—PRINCIPAL PLUS INTEREST

Mortgage Amount	Prin. and Int. at 6¾%		Prin. and Int. at 7%		Prin. and Int. at 7¼%		Prin. and Int. at 7½%		Prin. and Int. at 7¾%		Prin. and Int. at 8%	
	20 yrs.	25 yrs.	20 yrs.	25 yrs.	20 yrs.	25 yrs.	20 yrs.	25 yrs.	20 yrs.	25 yrs.	20 yrs.	25 yrs.
8,000	60.83	55.28	62.03	56.55	62.24	57.83	64.45	59.12	65.68	60.43	66.92	61.75
10,000	76.04	69.10	77.53	70.68	79.04	72.29	80.56	73.90	82.10	75.54	83.65	77.19
12,000	91.25	82.91	93.04	84.82	94.85	86.74	96.68	88.68	98.52	90.64	100.38	92.62
14,000	106.46	96.73	108.55	98.95	110.66	101.20	112.79	103.46	114.94	105.75	117.11	108.06
16,000	121.66	110.55	124.05	113.09	126.47	115.65	128.90	118.24	131.36	120.86	133.84	123.50
18,000	136.87	124.37	139.56	127.23	142.27	130.11	145.01	133.02	147.78	135.96	150.56	138.93
20,000	152.08	138.19	155.06	141.36	158.08	144.57	161.12	147.80	164.19	151.07	167.29	154.37
22,000	167.29	152.01	170.57	155.50	173.89	159.03	177.24	162.58	180.61	166.18	184.02	169.81
24,000	182.50	165.83	186.08	169.64	189.70	173.49	193.35	177.36	197.03	181.29	200.75	185.25
26,000	197.71	179.65	201.58	183.77	205.51	187.94	209.46	192.14	213.45	196.39	217.48	200.68
28,000	212.91	193.47	217.09	197.91	221.32	202.40	225.57	206.92	229.87	211.50	234.21	216.12
30,000	228.12	207.29	232.59	212.04	237.12	216.86	241.68	221.70	246.29	226.61	250.94	231.56

Installing Home Security Sensors

Protect your house against fire, flood, intruders and other common household disasters at a low cost

HOW WOULD YOU LIKE to buy the best kind of life insurance for your entire family for the price of a couple of movie tickets? Impossible? Not if you believe that the best insurance is the kind that saves lives rather than pays others after the lives are lost. Every year about 7,500 Americans die in fires started by accidents, negligence, vandalism, arson, faulty electrical wiring or appliances, malfunctioning heating systems, exploding gas lines, or by natural causes such as lightning. Why become part of next year's statistics when a low-cost alarm can virtually eliminate the possibility?

To buy the very cheapest fire protection, invest in a self-contained alarm that requires no special wiring. All you do is hang it where the fire hazard is greatest—perhaps in the furnace room or in a stairwell. Some models operate on inexpensive, easily-replaced flashlight batteries, other self-charging models require no battery changes, and still others require no batteries whatever. Compare the types available from your electronics supply store or hardware store.

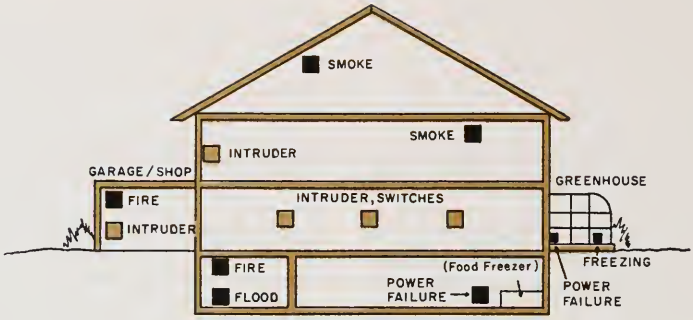
These small alarm units are ideal for apartments, or for very small homes. They may not be adequate in larger homes; for example, an alarm placed in the furnace room may not be loud enough to awaken sleepers in the bedroom area.

Most homeowners would be wise to consider a more sophisticated alarm system, especially since the same master unit can be used to detect fire, smoke, flooding, freezing, electrical power failure, and intruders. Considering the long-term protection offered, the cost is still very low.

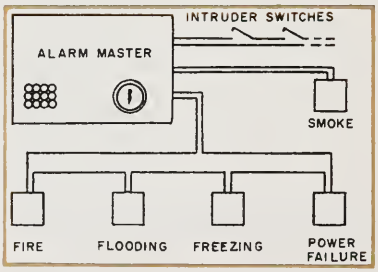
For example, the system shown in this article is priced at about $20 for the master unit, or only about $15 if you do the simple wiring yourself. To this basic price add the costs of the particular sensors you want: door/window intruder switch, about $3 each; smoke sensor, about $10; heat/fire, about $3; freezing, about $4; water flooding, about $6; power failure sensor, about $3. Incidentally, an automobile alarm kit, for about $9, makes the master unit usable as an auto alarm.

Intruder alarm. This system utilizes magnetic door window switches (or switches you can devise yourself), and break-wires. Only two flashlight "D" batteries are needed to power the unit; however, this system provides only a sound alarm, no flashing light.

You can also add a key switch that will permit you to enter and exit through a protected door without turning on the alarm. You can order such an "Exit Door Converter" for about $6. This key-operated switch temporarily short-circuits the door sensor. You could solve the problem at smaller cost by simply installing a small on-off switch outside the house, provided you



Example of a complete protection system. Various sensors are placed where trouble may occur. Note fire and flood sensors in the furnace/laundry room, power failure sensors for greenhouse and freezer. Intruder switches guard the likely entry points.



A three-input alarm master can handle as many as 20 sensors if several are used on each circuit. Note that the sensors on any one circuit must be wired in series. More than one master might be used to avoid excessive wiring.

can hide it where a potential intruder cannot find it.

Multiple function system. If you can locate the master unit close to the sensor(s) that you plan to use, all you need do is plug each sensor into a jack on the side of the master unit. If the sensors must be more than six feet from the master, you can extend the connecting lines by splicing in lengths of ordinary lamp cord. If this is more work than you care to undertake, check your local radio-electronics store for ready-made extension cords. Ask for cords having a male RCA phono pin plug on one end, and a female RCA phono jack on the other end. Take a sensor along to make sure the plugs fit.

Three different sensors can be plugged into one master unit. However, you can use as many as 20 sensors with one unit by wiring several sensors to each of the three jacks. Note that the grouped sensors must be wired in series, as shown in the illustration.

You may prefer to use two or more master units. This will eliminate the need to run wires all over the house. One master might serve the basement, another the main floor and garage, and a third the attic.

Fire detection. You can install as many fire detector sensors as you think are necessary to provide adequate protection. These might logically be located in the furnace room, in a stairwell, in the kitchen, and in the attic. The heat-fire sensors will sound an alarm when the air temperature rises to 134°F. The master unit should of course be located where it can be heard from any part of the house, expecially from the bedrooms since nighttime fires are most dangerous.

The more expensive smoke sensor is rec-

ommended for certain fire detection conditions. It will detect a smoldering fire that has not yet raised the room temperature high enough to trip the heat sensor. It is good for the kitchen, near the range, where the heat detector might trigger false alarms. Likewise, the smoke sensor may be indicated for the attic, especially in warm climates where normal attic temperatures can go as high as the critical 134 degrees.

Flooding freezing power. Many a homeowner has gone into his basement in the morning to find a duck pond in his recreation room. A flooding sensor, placed on the floor in known trouble spots, will awaken house occupants when film of water only $^1/_{16}$-inch thick contacts the sensor.

If you have a greenhouse, or plumbing that might be damaged by freezing conditions, safeguard these areas by plugging in a freezing sensor. When the temperature drops to 32°F., the alarm sounds.

Do you have a big freezer stuffed with hundreds of dollars worth of perishable foods? What might happen if a power failure turned off the freezer? Why find out the hard way when you can plug a power sensor into the same wall socket that serves the freezer?

Self-wired master. If you buy a prewired master unit, you need only plug in the sensors and add the batteries to make the system operative. If you want the fun of wiring your own master unit—and save money doing it—here are a few tips that will ensure success on the first try.

The master unit can be assembled easily within a couple of hours if you are reasonably adept with a soldering iron. Just be sure that you use the proper kind of iron—one having a very small tip and no more than 37 watts of power.

Follow the assembly instructions that come with the kit. To assemble the printed circuit board, simply poke the component leads through the appropriate holes in the board, cut off the extra wire, and solder to the printed circuit—carefully, using as little solder and heat as possible. It is not difficult, but it does require care. When it's done, examine the job with a magnifying glass for stray bits of solder and shorts caused by solder bridging the printed circuits. If you find such shorts, carefully

Sensors for freezing and flooding are typical of the many low-cost ready-to-install detectors available for use with the alarm master. Sensors plug into jacks at end of box. Rear bracket makes mounting master unit easy.

carve out the extra solder with a sharp knife or other tool.

The rest of the assembly is a cinch. Just bolt the wired circuit board, jacks, horn, battery holder and tumbler lock into the box; then make the few necessary wire connections. That's all there is to it.

How it works. The protection system operates by triggering a silicon controlled rectifier (SCR) which connects the horn to a 3-volt battery power supply. The SCR is triggered by a DC amplifier when the total resistance of the sensor series exceeds 10,000 ohms; this happens when any one sensor is activated.

To test the system, turn the key lock switch to the operating position. The alarm should not sound, whether any sensors have been plugged in or not. Now activate a sensor in the appropriate manner. Open a door having an intruder switch, blow smoke into the smoke sensor, and warm the heat sensor with a match. The alarm should sound immediately, and it should continue to sound even if the sensors are returned to normal conditions—as by closing the door, or cooling the heat sensor. The alarm horn can be turned off only with the key, or by letting the batteries wear down (about half an hour).

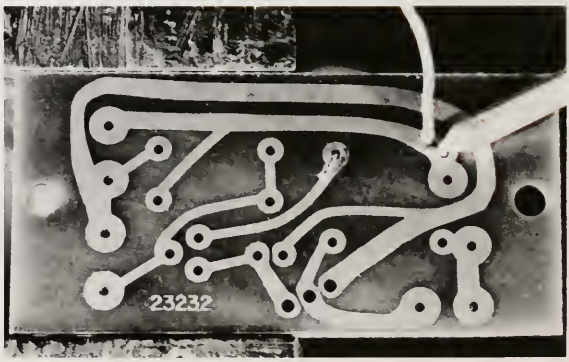
No alarm system is wholly effective unless it alerts someone to danger. So if your home is vacant much of the time and it is far removed from neighbors, the only feasible protection system may be one that automatically telephones the police, fire department, or anyone else you choose. They can be fitted with all the types of sensors discussed here. However, most homeowners can obtain ample protection from a far less expensive system. J.H.

See also: ALARMS, BURGLAR; SECURITY, HOME.

▲ *Place water flooding sensor on the floor and lead wire to the alarm master. Other sensors are just as easy to install. Although sensors are color coded, it's a good idea to label each. Also add date when battery is placed in water detector.*

WHERE TO FIND IT

The Knight system, described here, is sold by Allied Radio, 100 North Western Avenue, Chicago, Ill. 60680.



➤ *Save money by assembling master unit yourself. Most of the assembly is easy; trickiest part is soldering leads from components to small printed circuits. Use a low wattage soldering iron with a small tip and work carefully. The problem is avoiding shorts from the solder.*

Constructing Multi-sided Columns and Hoppers

Everything from lamp bases to veranda posts are now easy to construct with these tips on compound mitering setups, clamping methods and types of lock and column joints on straight and tapered staves

COLUMN CONSTRUCTION includes a large class of projects ranging from lamp bases to veranda posts, with planting tubs, staved nut bowls and built-up forms for turning filling in between. Boxes can be built in unlimited variety, giving scope for imaginative creations. Lock joints find their principal use in square columns, boxes, and cabinet drawers. Power tools simplify construction of this type so that even the more complicated joints offer only nominal difficulty.

Butted joints in columns are satisfactory for work to be painted and are regularly used in carpentry. For instance, a porch post or column may be built up of clear one inch stock, instead of solid stock which would certainly have knots. Moreover, the one inch lumber is likely to be better seasoned than the solid, with the expectation that it will hold paint better.

Two methods of construction can be used. For example, four pieces of equal width can be joined swastika-fashion to make a square section or, two narrow strips can be butted between two wider ones. The advantage of the first method is that all stock can be sawed to the same width, or the column may be proportioned to use boards of standard widths. The second method has an advantage when making groups of posts because the joints can be turned to the side where they are less noticeable.

If waterproof glue is used, the column can be painted as perfectly as solid posts. Use straight lumber for long posts. Strips ripped from wide boards sometimes spring, and should be cut extra wide to allow for straightening. Remove the rounded arrises on finish lumber by dressing the edges, so that the colomn joints will not show.

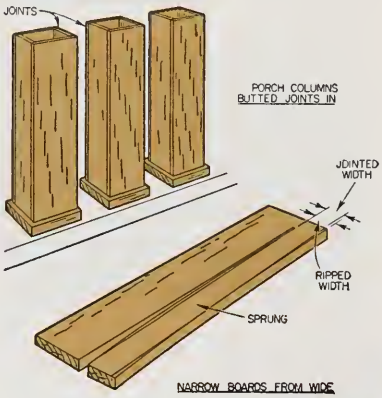
Mitered corners are necessary for work that is to be stained or given natural finishes. Miters are suitable for columns having any number of sides. In the average small shop the easiest method is to rip the miters with a circular saw and then plane on a jointer. Rip oversize to allow for jointing. When making strips from a wide board turn it over after each cut to utilize the ready-made mitered edge. A special fence will protect the sharp corner of the mitered edge. Cut a strip with a vee-groove in the edge and nail to another strip at right angles for clamping to the rip-fence. When sawing the groove in the protective fence, allow the saw cuts to overlap and form a recess at the bottom to clear the sharp edge of the mitered piece being sawed.

The miters present considerable glue

horizontal siding fence: see fences
horn switch: see electrical, auto
hot glue: see adhesives
hot water heating: see heating systems, home
house painting: see painting, house

surface and are strong enough for many purposes without reinforcements. The tendency to slide makes the column hard to clamp by ordinary means. A good method for a square assembly is to cradle three sides in handscrews which are set to exact column width. Lay the fourth side on top and clamp from top to bottom. First try the joints dry and touch up as needed with a hand plane. When gluing, correct misalignment by tapping the high points with a hammer, striking against a block.

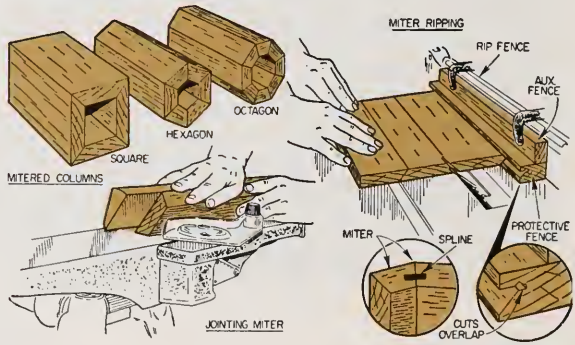
Staved assemblies can be clamped by encircling them with ropes twisted like tourniquets, or tied loops with wedges driven between them and the wood. Most satisfactory are band clamps having canvas bands which are pulled snug and held by cams while the screws are turned.



Splines strengthen the joints, and by keeping the miters from sliding on one another make the joints easier to assemble. Cut grooves with a dado head on a radial saw and insert a spline cut with the grain crosswise. Make the width slightly less than the combined depth of the grooves. Blind splines are difficult to manage because the cutter must be entered and withdrawn at right angles to the miter. This is accomplished by setting the near end of the piece against a kick-back stop while the revolving dado head is raised to cut full depth, then feeding until the forward end contacts the stop block. Stop the saw and lift off the piece.

Instead of splining, the edges may be worked with tongues and grooves, using a molding head for columns of more than four sides. For a square column, the piece can slide on the table. However, since the standard cutter is one inch wide it will leave a ridge at the inside which must be trimmed off. By running the tongue on one edge and the groove on the other, all sides can be ripped to the same width.

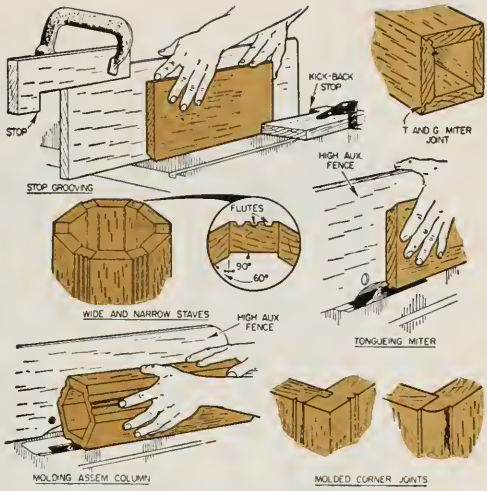
Staved columns are not confined to those with equal sides. Combinations of narrow and wide members are effective, and these may be molded. The simplest construction is to miter the wide staves as if they were being joined together, leaving the narrower



ones with square edges. This leaves an offset at the joint which can be evened by using thicker stock for the narrow parts. It is easy to mold a plain column after assembly on a circular saw. Corner moldings may be used to conceal butted joints, where the side of a bead is tangent to the joint on one side and a corresponding bead is worked on the other side, or where a quarter-round curves the corner, flanked by offsets. Many variations are possible.

Tapered columns introduce two complications. On short stock, the miter gage must be swiveled; on long pieces, a tapering jig must be used, and the saw table or arbor must be tilted, not to the angle for mitering a straight column, but at a somewhat blunter angle, depending on the taper of the column. This compound angle is often called a hopper cut because it is essential to the construction of boxes with sloping sides. The length or height of the box is given, its width at the top, and the taper or slope of the sides. The height (H) of the side is greater than the height of the box (h), because it slopes and is the hypotenuse of a right triangle, yet the top and bottom are the same dimensions as the box. Consequently the edges slope at a lesser angle than the tilt of the side. In a square box the horizontal angle of miter is 45°, but square with the edge (as the saw cuts), it is greater.

Tilts are often expressed in plans as "rise and run." For instance, instead of a tilt of 40° the plan could read $10\frac{1}{16}$ in 12 inches, and the taper jig could be set directly to this. To find the edge angle of a tapered side experimentally, take the height on the blade of a framing square, and the taper on the tongue, and span these points with a straight stick. Mark the points on the stick, representing the length of a side. Substitute this true length for the height on the blade, swing the stick between this new point and the old mark on the tongue, and you have the edge angle of the side. Take the base

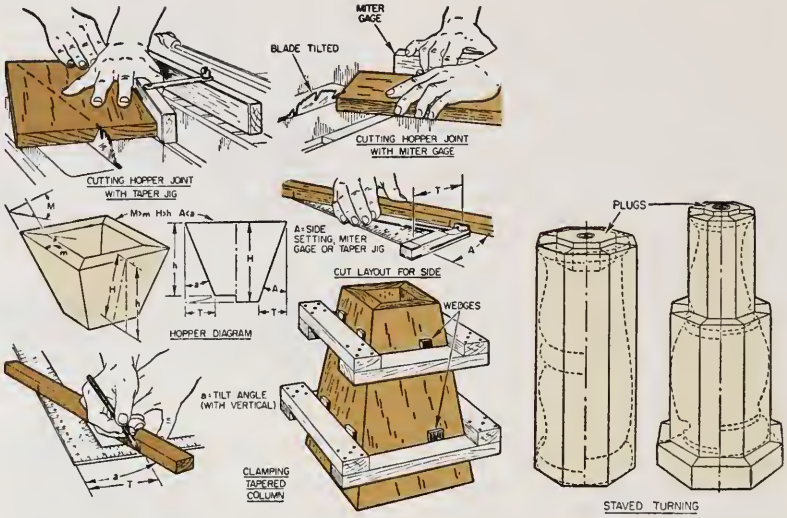


angle with a bevel square, and set the miter gage by it.

When gluing assembled square-tongued columns, make up square frames solidly nailed together and drive down over columns to serve as clamps. Drive in wedges where needed to slide the joints into perfect alignment. Where taper is considerable these frames may have to be lashed or clamped to the large end to keep them in position.

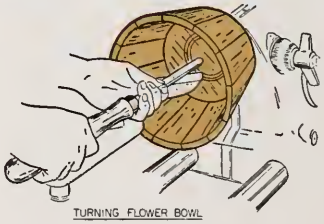
Staved construction is ideal for large turnings in several ways. The piece is lightened by having a hollow center; seasoning may be better than with solid squares and checks are unlikely; shrinkage can be made uniform by making all staves from flat-grained lumber, and both uniform and reduced to a minimum if quartered or vertical-grained stock is used. When used for a lamp base, there is a ready-made channel for the wiring.

While this built-up stock is most adapted to painted work, spectacular effects are possible when given transparent finishes, if the staves are selected for grain, especially in burls or in birdseye maple. In some cases it is advisable to use staves thick enough to enclose the deepest cuts, but with expensive



wood assemblies, various diameters can be joined. As parts of the joints are reduced in turning, they should be reinforced in large work with glue blocks rubbed in or clamped behind the joints. Plug the ends for spindle turning. For bowls, fit bottoms of 1 or 2-inch stock to screw to a face plate.

Boxes of many forms can be devised from built-up blanks. Rectangular boxes, being small and of thin wood, are made by a somewhat specialized technique. A sure way to make the lid fit the box is to build both as a single unit, sawing off the lid afterward. Smooth the edges by rubbing on a sheet of sandpaper held flat on the bench top. Glued and nailed square butted joints are satisfactory for most painted work or for boxes to be veneered. For natural and stained finishes mitering is better. Rip sides and ends to width, allowing ⅛-inch for sawing off the lid, rabbet the lower edges to take the bottom, and miter top edges and ends. Miter the top all around. A diamond-



pointed cutter on a shaper is good for this work.

Rabbeted joints, properly made, give the appearance of mitered joints. Rabbet as deep as the face veneer of plywood, or leave a thickness of a little under $\frac{1}{16}$-inch solid stock. Since there is danger of splitting off the thin lip, back up the piece with a block rabbeted to give a pushing ledge between the piece and the miter gage extension. When assembling, use stiff blocks along the sides or the end pieces may push the rabbet lips out under clamp pressure.

Lock joints engage in such a way that

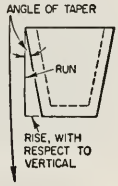
they prevent the joint from being pulled apart from one direction, or in some designs from two directions. To make a one-way joint between a ¾-inch drawer front and a ⅜-inch side, set up a ⅜-inch dado head and cut into a wooden auxiliary fence on the circular saw leaving ¼-inch of dado head exposed. Place the drawer front against the miter gage and the end against the auxiliary fence and cut a rabbet ½-inch deep. Next, move the dado head out ¼-inch from the fence, reduce its height to ⅜-inch, and groove the end as the top is held upright against the auxiliary fence. This completes the drawer front. Now mount a single dado blade, elevate it ⅛-inch above the table, and locate it ⅜-inch from the fence. Cut the dado in the drawer side.

In cutting a lock miter, the inner tongue might be cut in half, to strengthen the outer tongue, with a change of cutters. A shaper diamond-point makes the miter. With a full lock joint, one member is driven into the other; both pieces are ¾-inch stock. In the step-by-step diagram a ⅜-inch side is joined to a ¾-inch drawer front. Exercise care in assembling, or cross-grained members will shear off.

Dimensions for an eight-sided planter to be made from figured hardwood are given in the diagram. Sketch the thickness curve through ½-inch squares, cut a cardboard template, and trace on the edges of the rectangular side pieces. Bandsaw and then cut the angles, beveling the ends 72¾°. Use waterproof glue and assemble upside

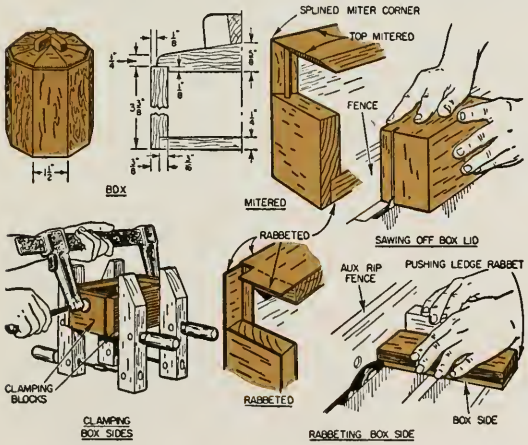
SPREAD OF TAPER JIG PER DEGREE OF MITER GAGE SETTING

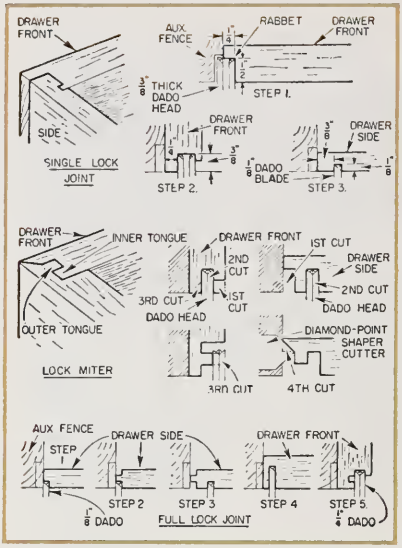
Miter Gage Setting (from Chart A)*	Degree of Slope with vertical	Spread of Legs measured at right angles to fence, 10 in. from pivot center	
		Inches	Plus 64th in.
85	5	0	28
84	6	1	3
83	7	1	14
82	8	1	26
81	9	1	37
80	10	1	49
79	11	1	64
78	12	2	8
77	13	2	19
76	14	2	32
75	15	2	43
74	16	2	55
73	17	3	37
72	18	3	16
71	19	3	28
70	20	3	41

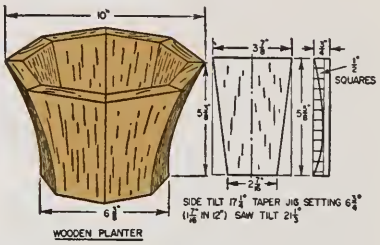


Above these values use miter gage

* Determined by degree of tilt and number of sides







down on the bench, clamping lightly until the ends are tapped into alignment. Mark out a bottom of one-inch stock, using the assembly as a template, and insert from the inside, pushing it down until it wedges against the sloping sides. Smooth the outside with a sanding drum, and sand the top, lightly rounding the arrises. Use the planter as a housing for a glass or metal dish of suitable shape.

See also: ADHESIVES; RADIAL ARM SAW; TABLE SAW; WOODWORKING.

DEGREES OF TAPER EXPRESSED IN RISE AND RUN, WITH RUN TAKEN AS 1 INCH

Degrees	Decimal Equivalent	Degrees	Decimal Equivalent	Degrees	Decimal Equivalent	Degrees	Decimal Equivalent
5	0.08749	19	0.34433	33	0.64941	47	1.0724
6	.10510	20	.36397	34	.67451	48	.1106
7	.12278	21	.38316	35	.70021	49	.1504
8	.14084	22	.40403	36	.72654	50	.1918
9	.15838	23	.42447	37	.75355	51	.2349
10	.17633	24	.44523	38	.78129	52	.2799
11	.19438	25	.46631	39	.80978	53	.3270
12	.21256	26	.48773	40	.83910	54	.3764
13	.23087	27	.50953	41	.86929	55	.4281
14	.24933	28	.53171	42	.90040	56	.4826
15	.26795	29	.55431	43	.93252	57	.5399
16	.28675	30	.57735	44	.96569	58	.6003
17	.30573	31	.60086	45	1.00000	59	.6643
18	.32492	32	.62487	46	.0355	60	.7321

N.B. To obtain taper per inch, divide rise per run. For example, the taper is given as 5 in 7. $5 + 7 = .7143$ or $35\frac{1}{2}$ degrees.

Which Hull Type is Right for You

Understanding the purpose of various types of hulls may help you choose the design best suited to your own requirements

IN BROAD TERMS there are just two kinds of hulls: planing and displacement. The planing variety is built for speed, and a fig for comfort. In theory, this type would work best if it were no more than a flat board with perpendicular sides. Under the application of power, it would leap into an instant plane, and nothing but a razor-thin line of trailing edge would actually make contact with the water. The displacement hull, on the other hand, gets its name because it displaces water with its own bulk. It does not plane, it plows. The purest form of planing hull is a flat-bottom, jaw rattling racing boat. The purest form of a displacement hull is the Queen Mary. Anything in between is a compromise.

This includes most pleasure boats. Al-

most always, they combine the chief virtues of both types of hull: forward, there is a vee-shaped displacement-type cutwater; aft, there is a flat planing area. These boats may be called either semi-planing or semi-displacement, but essentially they're the same. When a boat is described as semi-planing, chances are that the design emphasis is on details that make for warm performance; if it is called semi-displacement, it is likely to be more comfortable but slightly more stodgy.

In either case, a knowledge look at the aft section of the boat tells you instantly in which direction its compromises incline. If top mph is the goal, the planing area is severely flat and sharp-cornered, with an unrelieved, right-angled chine line. For safety and a softer ride, the chine is rounded or flattened into a "non-trip" form, and there may be some softening or subtle curving of the planing area. Every departure from lines that are straight and hard costs the boat a measure of top speed, but it buys some other quality that is just as important.

Few pleasure boaters are willing to put up with the jolting performance and hard handling of an all-out speed boat, but at the same time they tend to resent the tepid thrust of a boat which is over-committed to comfort. Fortunately, the stern realities of boat design are not rigid. With some careful attention to the aft section of the boat, you can probably find a dozen ways to improve speed and handling without sacrificing safety and comfort.

Working with the rear end of a boat mostly means making the most of what you have. The first step is finding out whether the portion of the boat that's supposed to be flat is really flat.

In a semi-planing boat, any aft deviation from flat is generally unintended. Occasionally, though, in a boat that leans heavily toward the displacement half of its mixed nature, there will be the concave deflection known as hook. When it is a deliberate part of the design, it is almost always found just ahead of the point where the bottom joins the transom. Back here, the hook acts like the flaps on an airplane. During the first few feet of take-off, it gives the craft a quick thrust of low-speed lift. But once the boat is on top of the water and planing, the hook tends to force the bow down. In this position, the cutwater splits the waves and tosses the remnants aside where they cannot pound against the jolt-prone aft. The result is a ride that is unusually level and soft, and usually dry—but not exceptionally fast.

For this reason, in today's speed-oriented craft, hook is seldom built in. But it sometimes develops accidentally, most often as a result of improper trailer support or careless cribbing in storage. The unpremeditated hook can show up anywhere along the keel line, and its effect on performance is approximately the same, but erratic and often exaggerated.

Hardly anything can make boat performance take a more spectacular dive than a well-paced hook. In fact, the results of a hook are likely to derive more from its location than from its size. Sometimes an irregularity that is enough to shove the bow completely under the surface is so slight that it can't be detected by the unaided eye. For this reason it's a good idea to check the planing area with a straightedge any time the boat shows symptoms of being hooked.

Working from the stern, lay the straightedge down the aft section, parallel to the keel, and sight down it. Any wave or depression should become apparent immediately. Fortunately, a hook is easy to fix. All you have to do is mark it out with a pencil, fill it with fiberglass and resin, and using the straightedge as a guide, feather the edges and sandpaper them smooth until the whole planing area is perfectly flat.

See also: BOAT BUILDING; BOAT BUILDING PROJECTS; BOATING; MAINTENANCE, BOAT; SAFETY, BOAT; STORAGE, BOAT; TRAILERING; TRAILERS, BOAT.

You May Not Have Missed That Bird

When working without a retriever, search the area after your shot. Absence of flying feathers does not mean the bird escaped. It could have gone down beyond your vision perimeter

CONSERVATION, AS WELL AS self-satisfaction, dictates that the hunter look carefully for downed game following his shot. Many upland birds and waterfowl fall outside your vision perimeter. Whether wounded or dead, such game should be recovered, and an immediate search is more effective than a postponed one.

Where retrievers are used, birds are recovered quickly. But the average hunter, working without a dog, can increase his bag substantially by a careful search for fallen game. Absence of feathers following the shot does not guarantee that the bird flew away unscathed.

The occupant of a duck blind, overlooking a large expanse of water, usually sees a duck fall, but the "puddle" shooter has more of a problem. Teal, mallards, gadwalls, wood ducks, and some scaup frequent small ponds and sloughs bordered with trees. Sometimes the hunter shoots at ducks flying over or through the trees where vision limitations prevent him from spotting falling game.

Recently, while working the neck of a small lake, a hunter jumped a flight of greenwing teal. He fired twice as they cleared the bordering trees. Not until the second shot did he see feathers floating downward. However, no one had seen a falling duck. Searching the area immediately, he found a teal which was quite dead.

Possibly he was concentrating so hard on the second target that he did not see the first duck fall. Nevertheless, a search produced the duck.

Hunting ponds, creeks, and sloughs—tree and/or brush bounded—occasionally hunters had to chase a wounded duck through the brush. If a hunter sees a duck fall in the brush, it is imperative that he retrieve immediately. The duck may have only a broken wing; but he still possesses surprising speed on foot. Frequently he will circle and try to reach the water from which

hutch: see storage
hutch, colonial: see early american
hyacinth: see flowering bulbs
hydraulic fluid: see power steering
hydraulic line: see drum brake service

If it is worth shooting, it is worth retrieving. When the bird falls, it will probably be out of the hunter's field of vision. A careful search of the area is the only way to find it.

he was flushed. It is best to begin your search immediately.

The dove hunter, on a waterhole stand, is similar to the duck blind hunter in that he can select a stand which permits a clear line of vision following the shot. Doves have a lot of stamina, frequently falling a surprising distance from the shooter. But if the hunter brackets the fall by noting cover peculiarities near the spot, he can usually find the game—if he searches long enough.

Frequently, a dove is winged, or takes a couple of pellets in a not-immediately-fatal spot, flutters to the ground, then disappears. A wounded dove, like other wildlife, quickly seeks cover, hence the necessity of an immediate retrieve. Doves usually seek brush, dead branches or other cover in which to hide. If the hunter goes to the spot immediately, sounds of the dove's fluttering should result in a retrieve.

Regardless of wildlife coloring, whether feathers or fur, each species seems to have a natural camouflage for every available background. There is little similarity between the coloring of a dove and a bobwhite, yet each dropped bird seems to blend completely into the earth cover whether it is weeds, grass or brush. Sometimes they're hard to see, even in a stretch of open ground.

Dove shooting is frequently confined to the afternoon, and best hunting usually develops 30 or 40 minutes before the deadline. This is particularly true of waterhole or flyway shooting. Waning light complicates retrieving. When light will not permit a quick retrieve—or a thorough search it is time to case your gun for the day.

The hunter working a dove feed area can minimize his losses by walking directly to the point where a dove fell, ignoring any other feathered temptation which may flush in front of him. One dove may be hard enough to find, but if the hunter is distracted by another his problem is compounded.

The dove's feed area will be a patch of weeds, native grass or a grainfield; and the gray feathers seem to blend with any pre-

vailing cover. However, an immediate search usually is more productive than one delayed.

If you do not handload, the empty shell case will mark the point of fire. If you do, carry some tissue or a rag which you can drop, if necessary, to mark the spot from which you fired. When looking for a downed dove, quail or pheasant, go back to firing point, take another look at the markers, then walk over and retrieve the bird.

Sometimes the momentum of a fast-flying dove will carry it quite a bit beyond the point where pellets connected. So it is a good idea to extend the searching range if the dove is not immediately found at the point mentally marked. This is particularly true in flyway shooting.

Bobwhite season usually opens after leaves have fallen and ground cover has turned brown. The speckled brown and buff-colored feathers blend naturally with dead grass and weeds. Downed quail are hard to find—without a dog—unless the

▲ *This pheasant will be easy for the hunters' retriever to find. It is when there is no dog that you must do the work.*

◀ *After shooting, mark the point of firing. If search does not turn up the game, go back to the markers and take another look. This will help you get the perspective on the area.*

hunter carefully marks the point of fall and goes directly to the spot. Any distraction, like shooting at another bird during the retrieve, makes the search more difficult.

Unlike the high-flying dove, a well-hit bobwhite usually drops "plumb" to the ground. Many times bobwhites are dropped closer to the gun than doves, making retrieve easier. And wounded quail register a much lower percentage of losses.

Occasionally, after a prolonged search, you can find a dropped bobwhite by varying direction of a search to provide a different angle of sunlight. Another procedure which works frequently is to make a circular search around the remembered, apparent point of fall. Each circular walk around the spot embraces a larger area.

Most dogs can be taught to retrieve. Even if they are not pointer or setter, they come in handy sometimes for retrieving jobs.

The hunter, without a dog, who hunts bobwhite in brush during the bedding hours has more of a retrieve problem than the open field hunter. Shooting within moderate range, careful observation, and immediate search after each bird is dropped will produce a higher ratio of retrieves.

It is expedient for the hunter to use his ears, as well as his eyes, in searching for a fallen bird. A wounded bobwhite, in heading for cover, sometimes will betray his whereabouts by a "cheap, cheep." Again, a winged quail may hit the ground running; and the hunter should carefully note the direction and follow immediately. The sooner you begin to track down your bird, the better the chances are that you will find it.

Gambel's quail frequently are shot in sparse cover and thus do not present the retrieve problem created by bobwhite in thick grass or brush. A dropped desert quail flutters more than a similarly-hit bobwhite, making retrieve a bit easier. Some hunters say that wounded desert quail, when possible, will hide in a predator's hole. However, they usually are shot at longer range than the bobwhite and should be retrieved immediately. Brilliant coloring of the desert quail makes them somewhat easier to find than the bobwhite—a dull-colored bird.

Because of their tendency to run—rather than hold—and because of the cactus-studded habitat, most Gambel's quail hunters hunt without a dog. Hence the necessity of a very quick retrieve.

If you have knocked down a quail—whether bobwhite or desert—begin an immediate search and forget the scattered covey momentarily. Assembly whistles, or calls, will direct you to some of the singles after retrieve is completed.

Choke is a bit more important than size of shot—within reason. However for puddle hunting of ducks use No. 6 shot; for doves use No. 7½ and 8; for bobwhite, No. 8 and 9; for desert quail, No. 7½ and 8. Those shot sizes seem best for normal ranges. Usually, it is best to use a double with improved cylinder and modified choke —carefully patterned before the hunt. Keep trying various powder and shot combinations until you find a uniform pattern. Even use high velocity for ducks, you may find that light loads are adequate for waterhole and feeding ground dove shooting as well as for both types of quail.

One definite way to reduce number of cripples is to practice consistently on clay targets prior to season opening. These targets, when hit, indicate whether the shooter centered the clay or caught the disc with a fringe. Consistent powdering of clay targets will help the gunner center his birds—and a dead bird is easier to find than a crippled one.

Whatever the feathered game, a careful, prolonged search usually will prove successful—provided it is a dead bird. These successful retrieves mean a bigger bag for the hunter, fewer lost birds, plus the satisfaction of finding well-dropped game.

See also: PATTERNING; RELOADING; SHOOTING; SHOTGUN; SHOT SHELLS.

Duck Hunters, Don't Ignore Those Ponds

When traditional lake and river shooting grounds aren't producing, try puddle-hopping; it's economical and convenient, and it yields ducks

MANY HUNTERS COLLECT their quotas of duck on ponds that dot the farm and ranch country along flyways, rather than on the traditional river and lake shooting areas.

Jump shooting isn't new; it's just becoming more prevalent because of the dispersion of ducks during the season. Soil and water conservation, along with increased livestock water demands, has resulted in a stepped-up program of pond construction. And these farm and ranch tanks and watershed reservoirs have provided food and home for countless numbers of ducks.

The greatest advantage for the average hunter has been convenience and economy. Decoys, blinds and boats are not necessary for this type of waterfowl hunting. And usually the small lakes and ponds are readily accessible.

A third advantage inherent in pond shooting is that ducks can be hunted throughout the day—in good weather as well as bad. If the ducks are there, the hunter usually can get some shots, and he's not dependent on decoy location or call effectiveness—or bothered by range restrictions.

Jump shooting may lack some of the glamor of decoying ducks or pass shooting, but it provides exercise, excitement and ducks. And if one pond is bare, the hunter can move on to another. He's not confined to blind and decoy spread.

Because of stock pond prevalence and increased pressure on the big lakes, ducks now are making full use of these small bodies of water. Although this applies primarily to the puddle ducks, divers frequently are mixed in with the shallow water feeders. And if there's not too much pressure on a single pond, the same ducks will return even after a few have been dropped by the hunter. Some teal return to the same small pond a second time within a 30-minute period.

Pond shooting requires very little technique—except the ability to make the approach for a flush within gun range. Usually there are a few trees around the ponds enabling the hunter to utilize cover for the approach. Frequently the dam plugs a gully which provides concealment until the hunter is within range. The dam itself enables the hunter to top out for the flush at a reasonable range.

Essentially, it's a matter of stealthy approach and flush within range.

Ducks are wary and become more sensitive to sound and movement as the pressure increases. On the lakes they can move out to the safety of open water, but on the

ponds safety lies in departure. Hence the need for a cautious approach by the hunter.

Larger ponds and small lakes necessitate pre-hunt scouting to determine where the ducks feed and raft up. If the ducks spend the night hours on a larger body of water, the hunter should try to learn where and how the waterfowl come in for early morning feeding. Then he can be in position before sunrise for some exciting shooting when the ducks jet in.

One hunter had some good shooting on a small lake several times because he was in position at sun-up when the teal came in. Previous scouting of the area revealed where the teal fed in the shallow water. A makeshift blind of logs and dead limbs provided adequate concealment. On two successive mornings the teal came into the same area and from the same direction and at about the same time.

Sometimes the hunter can score by working the sloughs of a lake. Such depression inlets usually have contour cover which conceals the hunter until he's ready for the flush.

If there are several ponds in the same general area, a team of hunters can work efficiently by assigning one to each pond. The respective approaches should be synchronized for approximately the same time. If ducks are moved from one pond, they'll frequently retreat to another thereby providing both hunters with shot opportunities.

Even after shooting at one or more ponds, it's worthwhile to recheck before departure. The ducks may return to the same pond.

Usually these stock pond ducks are teal, mallard or wood ducks; quite often a few scaup and a few ringnecks of the diver family. Although comparatively fewer in numbers, puddle ducks—including pintails, baldpates and gadwalls—also use the ponds and smaller lakes. But teal usually are the most prevalent—and the hunter can take a full quota.

An important advantage in this type of hunting is the opportunity to identify the ducks—particularly if the hunter scouts the area or can study them before making the approach.

This type of shooting usually is at fairly close range, and well within the scope of a standard 20 gauge—which actually is an ideal gun for jump shooting. Regardless of gauge, the hunter needs an open pattern, and some find an improved cylinder and modified to be just about right. The owner of a double, modified and full choke, will find the spreader load—either factory or hand loaded—to be efficient for many shots. The variable choke gun, of course, can be adjusted for the anticipated type of shooting.

Check the pattern of high-velocity loads employing the shot cup; they may throw too tight a pattern for close range work. Or, if hit, the duck may be badly mangled.

Heavy, long-ranging shot is not essential in jump shooting. In most instances the hunter needs high pellet count with a uniform, quick-opening pattern. No. 6 seems to be adequate in size, but on many occasions No. 7½, with the increased pellet count, would be better. Some also use No. 5, just because there are a lot on hand, but generally No. 6 is better adapted to range and shooting conditions.

Retrieving ducks that fall over water usually is not a problem because of the small size of the ponds. Wind, if prevailing, usually will float them to the bank. Rocks thrown close by and beyond a duck will ripple it in. And in many instances you can wade out for the retrieve. When you have access to a series of ponds frequented by ducks carry a long length of nylon cord with you. With a three-foot stick tied to one end, you can heave it out beyond the duck and eventually work the duck to the bank.

Wounded or lost ducks are a rare occurrence in this type of shooting. You seldom have to chase a winged duck through the

trees and underbrush surrounding the pond. Shots usually are at ranges conducive to a vital hit or a complete miss.

Most of these ducks are vegetation feeders, and delicious in flavor. Although the teal are smallest, they have a flavor justifiably extolled by the gourmet—and they're well worth the extras called for in a good recipe. Here's one you'll enjoy.

Sweet and Sour Duck

Four ducks
3 tablespoons cooking oil
1 can sliced pineapple
1½ tablespoons soy sauce
½ clove of garlic, minced
½ teaspoon salt
½ cup ginger
½ cup sugar
2 tablespoons cornstarch
½ cup water
½ cup vinegar
1 green pepper, cut in strips
1 small onion cut in rings
2 carrots, shaved into curls

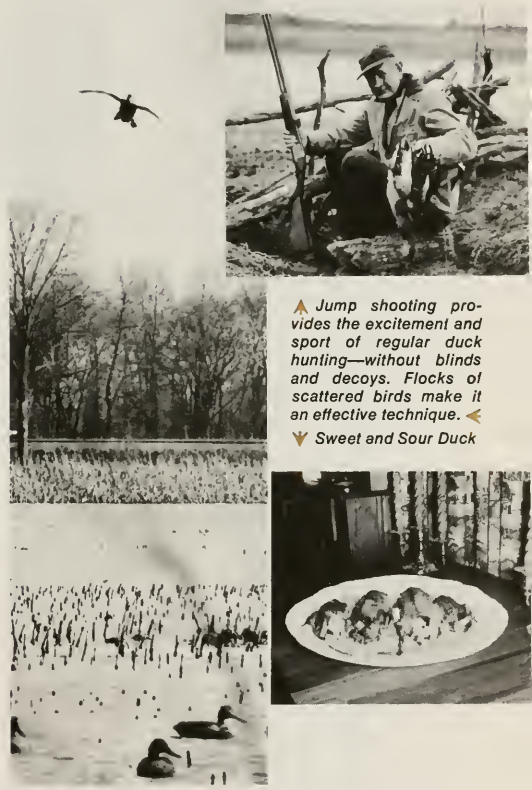
Place oil in dutch oven and brown ducks slightly. Mix syrup from pineapple, soy sauce, garlic, salt and ginger and pour over ducks. Bake at 325 degrees until tender, about 1½ hours, turning twice. Remove from pan. Mix sugar, cornstarch, water and vinegar, and add to pan drippings. Stir only until clear. Add pineapple chunks, green pepper, onion and carrots. Heat. Pour over ducks. Serve with rice—preferably wild. Serves four.

Picking and gutting a duck is a chore that has to be done—and the quicker, the easier. Intervals between pond approaches are good times to handle this routine.

Hunters who like to be on the move—who consider the blind a patience-taxing ordeal—will find jump shooting a satisfying and exhilarating method of hunting. It's inexpensive, productive and equipment-free. It's ideal on those cold, wet days when blind-confined hunters are shivering and cramped by inactivity. And it's good on those balmy days when many duck hunters don't consider a trip to the blinds worthwhile.

If there are ducks in the area, they usually can be found on the ponds and small lakes of farm and ranch country. Shooting is within reasonable range, retrieving is easy, and wounded, lost ducks are extremely rare. D.B.

See also: DECOYS; DUCK BOAT; PATTERNING; RELOADING; SHOOTING; SHOTGUN; SHOT SHELLS.



Jump shooting provides the excitement and sport of regular duck hunting—without blinds and decoys. Flocks of scattered birds make it an effective technique.

Sweet and Sour Duck

Tips on Dove Hunting

The average dove hunter is not highly skilled at wingshooting, but with these suggestions it is possible to accumulate a respectable bag at a modest rate of ammunition

IT IS SAFE TO ASSUME that more shotshell pellets are fired at doves than at any other winged game. This is particularly true in the South and Southwest where concentrations of the migratory birds in the fall attract thousands of hunters. It is also probable that the dove is dear to the shotshell makers.

Quail hunting attracts many specialized shooters but everybody goes after doves. And the average dove hunter is not as skillful a wingshot as the dedicated quail-and-dog hunter. Also, the seasonal concentration of doves in many areas provides more shot opportunities than that typical of local upland birds. Hence the piles of shotgun hulls that characterize the dove fields.

Some say that the dove is easy to hit; others describe it as a difficult target. But the hunter can collect a respectable bag, at a moderate outlay of ammunition, if he selectively patterns his gun, practices on flying targets, and shoots within range of load and ability.

The easiest way to pick up a limit of doves without spending a small fortune on shot is on an afternoon waterhole stand. Doves water regularly. And, before pressure makes them wary, they are not particularly hard to drop. Doves' approach to the waterhole is comparatively slow, their aerial antics are not so varied, and usually they approach in pairs, triples, or more. Lead is not the complicated problem that characterizes flyway or flight shooting.

The hunter needs a bit of cover such as brush, tree branches, or a makeshift blind made of dead limbs. If the waterhole is small, the stand should be sufficiently distant to permit opening up of the shotgun pattern. The hunter should be partially con-

cealed but ready to fire when doves are in range. The unmistakable beat of dove wings nearly always alerts the hunter. Sudden exposure of the hunter, just prior to the shot, usually will slow down the dove in flight as it maneuvers to swerve or to gain altitude. This is the time to shoot.

The dove may glide in or descend in a braking flutter of wings. And this is the moment when the target is most vulnerable. Too much—or too early—exposure of the hunter may tip off the doves in advance, enabling them to gain speed and altitude; and at that time shooting is similar to flight shooting.

Frequently, when doves approach the waterhole they alight in a distant tree to appraise the situation. Consequently the stand should be selected to intercept the dove's approach to the tree or subsequent approach to water.

This habit of doves to alight in a tree—frequently a dead one—near the waterhole makes the use of decoys effective. Doves are gregarious and will decoy to other doves or to decoys. Every hunter has observed flocks of doves perched in trees or on telephone or power lines.

Doves usually come in to water at any time from mid-afternoon to sunset, depending on prevalence of water and hunter pressure. Later in the season they delay watering, frequently coming in after the sunset deadline. And often they will glide to the ground, unseen by the hunter, and sneak in.

The hunter on stand should be sure he has a good perimeter of vision both to see doves' approach and to watch the bird after the shot. Many doves are wounded and lost because the hunter's vision was obstructed and the dove fell to the ground unseen.

It is advisable for the hunter to observe range markers such as clumps of brush, trees, dead limbs in the water and confine his shooting to that range consistent with the gun and his ability. This is particularly true if the hunter is using the standard 20 gauge. If 35 to 40-yard markers are identified, or mentally projected, the gunner can consider any target within the markers potentially shootable.

Gauges for waterhole shooting can be 12, 16, or 20 gauge. You will probably find improved cylinder and modified to be the most effective chokes in a double. On the smaller tanks, where ranges are comparatively close, improved cylinder and modified are ideal; and this is where the 20 gauge proves quite versatile.

Most popular shot size is No. 7½; and many hunters prefer high velocity loads. However, on many cattle tanks you can use ⅞ oz. of No. 8 in a 20 gauge improved cylinder barrel and 1 oz. of No. 7½ in the modified barrel. This combination seems to be effective. The important thing is to have a wide, uniform pattern at average shooting ranges.

Hunting doves on their feeding ground does not usually provide the comparatively easy shooting typical of the waterhole but such hunting can cover a longer period of time. After their noonday rest in trees, doves move out to the feed area; and the hunter walks them up in the fields. This can be fairly close-range shooting or a bit difficult, depending on the degree of hunter pressure.

In the north central Texas area, sunflower seeds are a great favorite of doves. Where sunflowers grow tall, the hunter can make a comparatively close approach before the dove wings away. A second preferred food in this area is a member of the croton family, commonly called dove weed. These small, round black seeds are great favorites, and if doves are around, they will usually be where dove weed grows.

Maize, and similar feed crop seeds, attract doves in great numbers, particularly after harvest. You may also have good shooting in peanut fields during the harvest-

ing period. Concentration of doves in certain feed areas is easy to determine if the hunter scouts around prior to the hunt.

Walking up doves on the feeding ground is more stimulating than sitting on a waterhole stand, but the ratio of hulls to bag is more disproportionate. If several hunters are working a field, it is productive to team up in relays. One or more hunters walk up the doves while the others take stands. If the field is bordered by trees, the alarmed doves usually will head for the shelter of trees. This type of hunting provides shot opportunities both for the drivers and those on stands.

Doves normally do not flush into an explosive flight like bobwhite, but their aerial maneuvers are more varied. They may rise quickly in an effort to gain elevation, while low over the field, or fly directly away from the hunter at a low altitude. You may also find it helpful, when walking them up, to avoid a background of trees which would make the flying dove difficult to see.

Range is more difficult to estimate when the hunter is walking. He does not have the advantage of the stand hunter who can select visible markers to determine his firing perimeter. The apparent size, and coloring, of the flying dove can help somewhat in estimating range. However, because of wing span and tail feathers, the dove appears to be a large target and draws fire many times when range is beyond the gun's killing pattern.

In heavy ground cover, a dropped dove frequently is difficult to find. Consequently, it is advisable for the hunter to retrieve each bird immediately—while ignoring other tempting targets. This is particularly true with wounded doves.

For hunting doves on the feeding ground good weapons are a Winchester '97, Cutts Compensator equipped, with both the all-purpose tube and the modified tube; a side-by-side double in 12 gauge that patterns approximately 45 percent and 55 percent; and a 20 gauge OU with improved cylinder and modified barrels.

If you are using the OU 20 early in the season load with ⅞ oz. of No. 8, later shifting to 1 oz. of No. 7½ in both barrels. Each load has approximately the same number of pellets; and in handloads they pattern satisfactorily.

Many hunters probably use guns with too much choke (too small a pattern) for waterhole and feed ground shooting. Shotshells with protective shot collars produce patterns denser than those thrown by the old conventional components. Thus a double gun that patterned improved-cylinder and modified with the old shotshells should throw a killing pattern to a bit longer range with the new plastic ammunition.

Flyway, or flight, shooting is the most difficult of the three types of hunting. The doves are flying faster and higher; and lead is more complicated. This type of shooting provides more opportunities when the doves are flying to water or from water to roost—and in the latter instance, time and light are running out.

In this type of shooting there is a tendency for the hunter to ignore the pile of hulls after he has collected a limit of doves.

For flyway shooting, use a side-by-side 12 bored modified and full. Loads usually are 1¼ oz. of No. 7½. Diameter of killing pattern, of modified choke, at 35 yards is approximately 42 inches, with an ideal range of 26 to 42 yards. Diameter of killing pattern, of full choke, at 40 yards is approximately 42 inches, with an ideal range of 30 to 50 yards. Diameter of killing pattern, of improved cylinder, at 25 yards, is approximately 42 inches, with ideal range of 19 to 30 yards. Thus, improved-cylinder and modified usually are adequate for waterhole and feed ground shooting; and modified and full chokes effective on the flyway.

Shot size and weight preference varies among hunters but objectively there are a couple of facts that should be recognized. The smaller pellets lose velocity faster, but there's a greater number, in equal weights, to form the pattern—other factors being equal. Consequently, choice of shot size, within reason, depends primarily on average shooting ranges. There is a third factor: the shot size, pellet count, and powder charge which patterns best at normal shooting ranges. Shotguns, like rifles, seem to have a preference for loads, and the hunter should try available loads on the pattern board and select those which produce the best killing patterns at average ranges.

Heavy, or high-velocity, loads are not necessarily the best—unless they pattern well in the particular gun and the hunter shoots within that range.

Even with the finest pattern, there is still the problem of lead; and here also there is a diversity of opinion. Yet most hunters agree: a missed dove usually is one that was ahead of the shot charge. Whether crossing, rising, or descending, most doves are missed because the shot charge rippled the air behind the bird. This may be back of, below, or above the dove, but the shot charge was still behind the target.

Lead, is something the hunter must learn for himself. Because of individual variations in mounting, reaction time, and sight picture, no two shooters see the muzzle-target relationship—at the time of the shot—in quite the same way. And interpretation of apparent lead varies considerably. Sometimes the shooter knows, because of dove's reaction, how the shot charge missed the bird—and usually it is behind the target. Whether the hunter spot-shoots, overtakes and passes in a fast swing, or uses sustained lead, the muzzle must be pointed ahead of the dove if shot charge is to intercept the target. You never get a motionless target; and seldom a true, level flight straight-away.

Another cause for misses, in the fast swing and in sustained lead, is a stopped gun at the time of fire. There seems to be a tendency among some shooters to freeze the gun at the moment when the sight picture looks correct. And in these two types of shooting you cannot hit a moving target with a stationary gun. This is best illustrated if one watches an excellent wingshot swing and follow through with a fast-moving target.

One factor that helps the wing-shooter improve his lead is the accumulation of memory pictures of the muzzle-target relationship at the time of the shot. When he hits, his mind should register the apparent lead which caused the shot charge to intercept the dove. When he misses, the same muzzle-target relationship often is registered. After a great deal of shooting, the gunner automatically senses when the sight picture appears right.

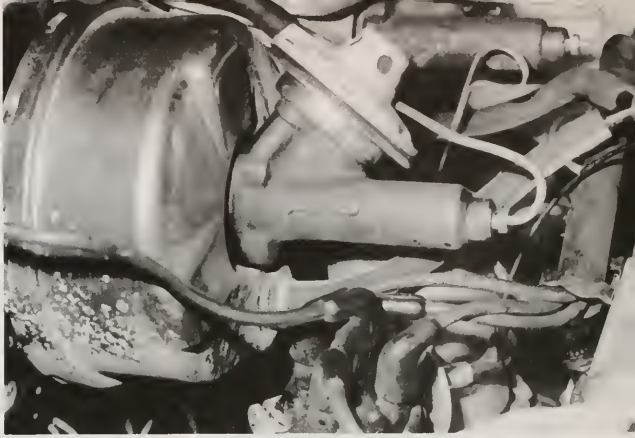
Seasons are too short and game too scarce for the average shooter to get sufficient practice on live birds. Clay targets provide the only practical means of adequate practice. An inexpensive hand trap is satisfactory, and the cost of shotshells and clays will be offset by the ratio of doves to hulls in the field.

To increase his average, the hunter should select a choke and a load—patterned—adequate for average rational shooting ranges. He should practice on clay targets whenever possible. He should restrict his shooting to those ranges within the potentials of the gun and his own pointing ability. And he should make every effort to retrieve wounded or dead birds.

If a limit of doves over-inflates the ego, the hunter can always compare hulls with the bag and possibly avoid excessive out-of-range shooting on the next hunt.

It's the ratio that counts.

See also: DECOYS; DUCK BOAT; PATTERNING; SHOOTING; SHOTGUN; SHOT SHELLS; SKIFF. HUNTING AND FISHING.



The single master cylinder. No car uses just this unit anymore. This particular one is from a foreign car that uses two single cylinders, one for front brakes, a second for rears.

How Hydraulic Brakes Work

Why your car's disc or drum brakes work when you step on the pedal

ALL PASSENGER CARS today use hydraulic systems to apply the brakes. Whether the brake shoe is a flat pad clamped against a disc or arc-shaped and pressed against a drum, a hydraulic system does the clamping or pressing. The pressure is supplied by your foot on a pedal, and the principles of hydraulics take it from there.

If you have an older car, it has a single master cylinder system. Even if you have a newer car with a dual master cylinder, a basic understanding of hydraulics and the single master cylinder will make the transition to the dual system easier.

Hydraulic means fluid, and fluids used in brake systems are virtually incompressible under pressure. Because it is incompressible, fluid makes an excellent transfer medium for the pressure applied by your foot (with possibly an assist from engine vacuum).

A basic principle of hydraulics is that pressure exerted at any point on a confined fluid will transmit this pressure equally in all directions. In a braking system, the fluid is confined to cylinders and tubing, using rubber seals to prevent leakage and loss of pressure.

Hydraulic theory. A simple example of how hydraulic pressure works would be the following—a main cylinder and piston whose circular face has an area of one square inch connected through tubing to a cylinder and piston with a face area of one square inch and another with a face area of one-half square inch.

The system is filled with liquid, and 100 pounds force is applied to the main cylinder piston. Because hydraulic pressure is transmitted equally in all directions, the force against the one square inch piston will be 100 pounds; and against the one-half square inch piston, 50 pounds.

In actual practice, the cylinders for the front wheels are larger in diameter than the rear wheels (permitting the installation of pistons with greater face area in front).

This means that the front wheel cylinders will accept greater force, which is desirable. During braking, by the laws of physics, there is weight transfer to the front of the

hydraulic tappets: see engine
hydraulic valve lifters: see engine
hydrofoil: see racing boat

car, where, due to the engine, most of the weight is to start with.

The greater traction is therefore on the front wheels, and the maximum braking effort should also be on the front wheels. If you have owned a car for any amount of time, you know from experience that the front wheel brake linings wear out before the rear linings.

Hydraulic cylinders. The main or master cylinder, to which the brake pedal is directly connected by linkage, comprises a fluid reservoir, a piston assembly with seals, and a valve assembly. The valve maintains a slight pressure in the brake lines so that the system will respond quickly when you press on the pedal. The slight pressure also tends to keep the wheel cylinder seals partly flexed for best sealing.

Note: this residual pressure in the brake lines is not designed into disc brake systems. Cars with front discs and rear drums have the check valve, plus a bypass for fluid to the discs.

The master cylinder reservoir has two passages to the cylinder itself, the compensating and breather ports. As you get ready to hit the brakes, there is no pressure on the master cylinder piston. Fluid from the reservoir flows through the compensating port to the part of the cylinder ahead of the piston, and through the breather port to behind the piston.

As the piston moves forward by force transmitted by the brake pedal, the rubber cup seal—called the pressure cup, in front of the piston—covers the compensating port, trapping the fluid ahead of it in the cylinder. The breather port remains uncovered and allows fluid to flow into the space behind the piston, keeping the space between piston head and the secondary sealing cup filled with fluid. The piston's forward motion forces fluid through a check valve at the front of the master cylinder to actuate the little cylinders at the wheels. These little wheel cylinders spread the brake shoes against the spinning drum to stop it, and the wheel attached to it.

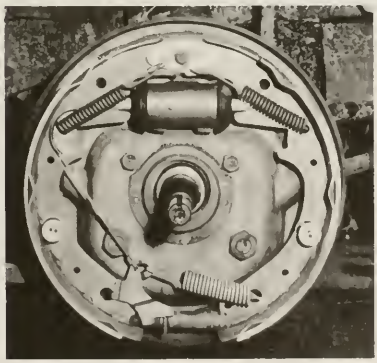
When the brakes are released, the piston starts to retract, but the check valve at the front of the cylinder limits the flow rate back into the master cylinder on the pressure side of the piston. To prevent the possibility of air entering the cylinder, there are drilled holes in the piston head, which permit fluid to flow from behind the piston, through it.

The release of pressure permits the seal, which had flexed to hold pressure, to relax, and the fluid that flows through the piston continues around the lip of the primary cup.

This design has another feature: it permits pumping the brake pedal to apply the drum brakes if the shoe-to-drum clearance is excessive. This occurs because it allows more fluid to get into the lines, and the incompressible fluid just pushes the wheel cylinder pistons out further,

When the brakes are released, the brake shoe return springs pull the shoes back, and put a return force on the wheel cylinder

Fluid from master cylinder exerts equal pressure in all directions. Pressure transmitted to each wheel cylinder operates on pistons, pushing them out. Pistons push out actuating links spreading brake shoes against drum.



pistons. The force is transmitted through the hydraulic fluid, and lifts the master cylinder check valve off its seat. The inrushing fluid pushes the piston and primary cup back, uncovering the compensating port and allowing the extra fluid that entered the system to return to the reservoir.

Wheel cylinders. Now let's look more closely at the wheel cylinders. There are three types of drum brake cylinders and several in the disc system.

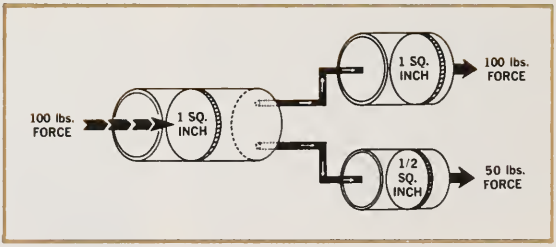
The drum types are single piston and two dual piston designs, one with equal bores, another with different size bores. The cylinder contains a sealing cup for each piston, a positioning spring or springs, rubber dust covers for each cylinder opening, and an operating rod from the piston to the brake shoe.

The disc types also contain a piston, a dust seal, sometimes a spring behind the piston, and a seal that fits in a recess in the cylinder bore.

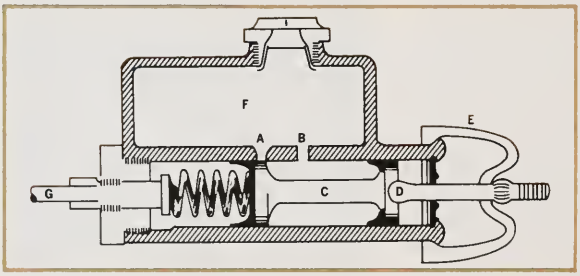
To test the hydraulic system, brace your foot on the brake pedal and hold it there for a minute or more. If the pedal holds firm, your hydraulics are in good shape. If it gradually sinks to the floor under continued pressure, then fluid is leaking somewhere. Correct this by inspecting flexible hoses and other brake pipes for leaks. Replace faulty hoses or tighten leaky connections. If moderate tightening does not cure the leak, replace the fitting. Leaks at the master cylinder or in the wheel cylinders should be fixed promptly because loss of hydraulic fluid can cause complete brake failure even when the power assist system is working perfectly.

Note: on cars with power brakes, the test can be made with the engine running, and as a double-check, with the engine off. After turning off the engine, release vacuum by applying the brakes several times. Then hold firm pressure on the pedal. P.W.

See also: DISC BRAKES; DRUM BRAKE SERVICE.



Principle of hydraulics is illustrated. 100 lbs. of force in a main cylinder is applied, such as your foot on the brake pedal connected to the master cylinder by linkage. Pressure is exerted equally in all directions, so there is 50 pounds of force against a cylinder with a 0.5 square inch bore, 100 pounds against a cylinder with a one-square-inch bore.



Cutaway of a typical single master cylinder, shown in the applied position and covering the compensating port "A." Other parts are: breather port "B"; piston "C"; pushrod "D"; dust cover "E"; fluid reservoir "F"; tubing to wheel cylinders "G."

How the Ignition System Works

This is what happens when you turn the key in your ignition switch

WHEN YOU TURN THE KEY in your car's ignition switch, current flows from battery through switch to primary winding of coil through ignition points, which when closed complete the circuit to electrical ground. This creates a magnetic field in the coil.

As the engine turns, the distributor shaft turns and the distributor cam opens the points. The opening of the points causes the magnetic field in the primary winding of the coil to collapse on the secondary winding.

Because the secondary winding is much finer and has many more turns, a greater voltage is induced in the secondary.

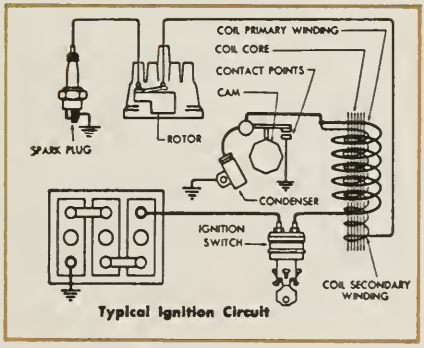
The high-voltage electricity goes through a wire from the coil to the top of the distributor cap, through the distributor to the rotor, which spins with the distributor shaft and is designed to transfer this high-voltage electricity to the correct spark plug wire, firing the plug.

The condenser is the system's shock absorber. Not all the current goes into the secondary. Some of it tries to flow through the points. However, they are open, and if the current were not given another path, it would arc across the points, burning them.

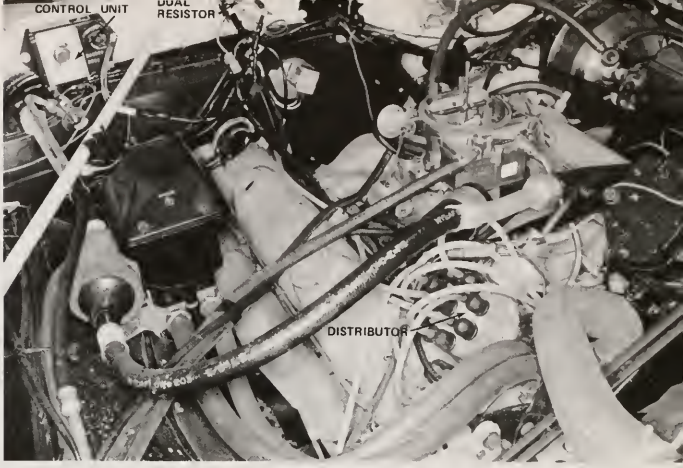
It would also create another path for the high-voltage electricity in the secondary, and some of it could bleed off and follow the arc across the points.

The condenser absorbs the current and then discharges it as the points close, preventing damage to them. P.W.

See also: ALTERNATOR, AUTO; BATTERIES; DC GENERATOR, AUTO; ELECTRICAL, AUTO; PARTS REPLACEMENT, ENGINE; SPARK PLUG; TUNE-UP, ENGINE.



Typical Ignition Circuit



➤ *A Chrysler Corp. electronic ignition system installed in a V-8 engine.*

How to Service Electronic Ignition Systems

These new systems are very much like the conventional ones except under the distributor cap; here the condenser and breaker points are replaced by an electronic pickup and a control unit

ELECTRONIC IGNITION has been a long time coming as original equipment, but it is finally in widespread use. Accessory systems have been available since 1962, including a few that were factory-installed, but it was not until 1972 that it became standard on a significant number of cars.

The changeover began at Chrysler Corp. in the United States. The reason for the industry's hesitation was cost: an electronic system to eliminate the replacement of breaker points and condenser cost at least as much as all the sets of points and condensers a car normally would need, and the labor to install them. Additionally, there was some question about the reliability of the early electronic components.

The spur to electronic ignition as original equipment came from increasingly stringent exhaust emission regulations. The solid-state devices provide higher voltage at all speeds, precision in ignition timing and reduced maintenance—all of which are necessary to keep emissions low for long mileage intervals.

The electronic system is really not much different from the conventional one, except for elimination of breaker points and condenser in the distributor. They are replaced by an electronic impulse pickup (a type of electro-magnet) and a control unit (a transistor circuitry box that really does the job of the points).

Some other parts in the system are modified. We will use the Chrysler system as an example. Specifications given are for typical Chrysler units, and specification charts should be checked for the latest figures.

The major component that was modified

was the primary circuit resistor. In conventional systems, it was either a ceramic ballast resistor or a special piece of resistance wire spliced into the circuit. Now it is a dual resistor ceramic unit. One of the resistors does the job that the old single one did: it reduces primary voltage from 12 to about eight, to protect the ignition coil, which is designed to operate on that lower voltage.

The auxiliary part of the dual resistor reduces the voltage of the electronic signal from the pickup to the control unit, to safeguard the transistorized circuit.

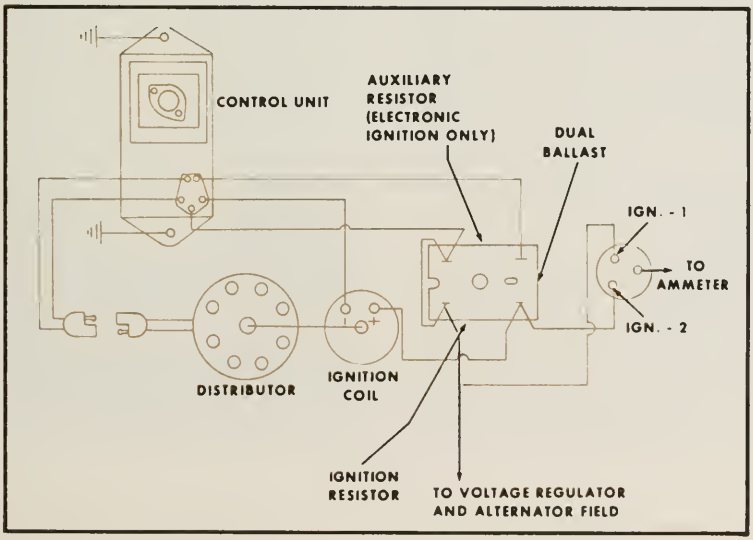
Instead of a distributor cam with lobes to open the breaker pointers, there is something similar called a reluctor. The lobes are there, but shaped differently, and instead of opening breaker points, they provide a spark signal to the pickup. This occurs when a reluctor lobe is directly opposite the pickup's little coil, which has a magnetic field around it (created by a permanent magnet and an electro-magnet).

The reluctor lobe rotates into the magnetic field, upsetting it. The result is a voltage signal to the control unit which electronically breaks the circuit to the ignition coil. The magnetic field in the coil collapses to produce the high-voltage electricity that goes to the spark plug, in the same way that it did when the circuit break was accomplished by the distributor cam lobe opening the breaker points. The transistor circuit break is much more precisely timed, however.

The ignition coil, distributor cap, rotor, spark plug wires and the plugs are all exactly the same as in the conventional system.

Some checkout procedures on electronic ignition, and some basic maintenance are different, however.

The most significant change for the weekend mechanic is that the old check and adjustment of the breaker point gap is replaced by a check of the gap between the pickup and the reluctor lobes, and adjustment if necessary. The gap is measured between the small metal lump protruding from the pickup and the reluctor lobe. If the gap is not within specifications, it is



Schematic of an electronic ignition system.

adjusted by slackening the pickup's lock screw and moving the pickup in or out.

The gap must be checked with a nonmagnetic feeler gauge, such as the one illustrated, which is of brass. Ordinary feeler gauges are made of steel and will be drawn to the coil's permanent magnet, distorting the feel of the gap.

Unlike the conventional breaker point system, the air gap in the electronic system should be such that only the slightest hint of drag is felt when inserting or removing the gauge. The moderate drag of the breaker point system adjustment will produce insufficient clearance.

The main reason for the air gap is to insure that no reluctor lobe strikes the pickup during engine operation. As a distributor shaft bushing wears, it permits a certain amount of side-to-side rocking of the shaft, and even with a normal amount of bushing wear, a reluctor lobe could be driven into the pickup. The gap also must not be too great, or a proper signal to the control unit might not be provided.

Another aspect of maintenance that is different is dwell, which in a conventional system is the number of degrees that the ignition points are closed. The air gap between the pickup and reluctor does not affect dwell, which is strictly an electronic function designed into the control unit's transistor circuitry. Therefore, although you should check dwell with electronic ignition (it's done with a dwellmeter the same way as with a conventional system), you cannot adjust it. If it is not within specifications, the control unit must be replaced.

Because dwell is an electronic function, you do not have to adjust the pickup-to-reluctor air gap (even if necessary) before you check and adjust ignition timing. The air gap adjustment can be checked and made afterward. It is good practice to check dwell beforehand, however, just in case the control unit is out of specifications.

What goes wrong. Although the electronic ignition system does not require periodic replacement of breaker points and condenser, it still has components that may become damaged or defective.

For example, if the pickup's setscrew fails to hold the pickup in place, normal engine vibration could send the pickup into the reluctor, and both parts probably would require replacement.

The ballast resistor could change resistor values or possibly burn out from an overcharging alternator. Check each section of the dual resistor with an ohmmeter across the terminals.

The Chrysler primary ignition resistor should read 0.5 to 0.6 ohms. The auxiliary resistor should read 4.75 to 5.75 ohms. You can tell the two resistors apart this way: the dual unit is rectangular and each terminal of a pair is at one end of the long side. Also, the primary resistor has one wire connected to the distributor; the auxiliary resistor has both terminals wired to the control unit.

If either resistor is out of specifications, replace the dual unit, to prevent starting problems and/or failure of the pickup or control unit.

Note: the resistor is bypassed during engine cranking, so if the engine starts but immediately dies when you release the key, the resistor is clearly defective. Do not use a jumper wire across the resistor terminals, even as an emergency procedure, for it can cause permanent damage to the electronic components in very short order.

The pickup can be tested with an ohmmeter. Disconnect the connector of the dual-wire lead and hold an ohmmeter probe against each of the two wires' connector terminals. Resistance should be 400 to 600 ohms. If resistance is above or below specifications, replace the pickup.

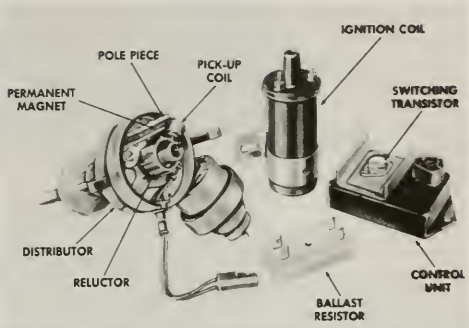
Check the insulation in the pickup by holding one ohmmeter probe to an electrical ground, the other to either terminal

of the dual wire connector. The ohmmeter reading should be infinity, and if it is not, replace the pickup.

A defective pickup can cause engine surge, which normally is associated with a lean fuel mixture. To check, turn the carburetor mixture screw toward the rich position (counterclockwise). If the surge can be adjusted out, the problem is solved. If it cannot, disconnect and plug the vacuum line at the distributor, and if the surge now goes away, the problem is in the pickup. Replace it.

The control unit is a piece of solid-state circuitry, but it can be affected by vibration and heat. Unless you have the special tester designed to check out this unit, the only alternative is substitution. The control unit is expensive and should only be replaced if everything else checks out, including the ignition coil, which also can be checked only by substitution (unless you have a coil tester or oscilloscope, not normally in the weekend mechanic's garage).

The ignition coil is a standard one, so you can "borrow" one from another car to check. Unless you have access to another car with the same electronic ignition, however, you may have to make a substantial investment in a control unit. A suggestion: you may be able to buy a control unit from a parts house that permits you to return unneeded parts for a moderate handling charge.



▲ *Pictured here are the key components of an electronic ignition system. Note the dual-ballast resistor and new distributor parts.*

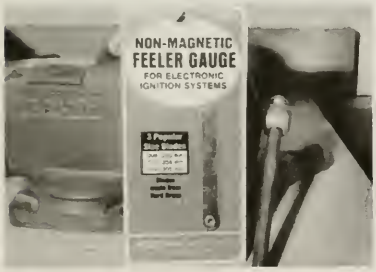
General procedures. When working on electronic ignition, don't forget the basics of any ignition system, for they will help you trouble-shoot. If there is no spark to the plugs with the engine cranking, check the coil, coil wire to distributor cap, rotor and the cap itself.

Also look for loose or corroded connections and broken insulation on wires; electronic ignition is very sensitive to these. It is also extremely sensitive to pinched wires, so if the wiring from the pickup to the resistor and control unit is pinched between the distributor cap and body, the car probably won't start.

If you need replacement parts, check with a general parts house, preferably the type that serves professional mechanics and also caters to weekenders. It should carry replacements for electronic ignition components. These parts, made by independent manufacturers, normally will be just as good as original equipment, and you should get a discount, too. P.W.

See also: ELECTRICAL, AUTO; PARTS REPLACEMENT, ENGINE; SPARK PLUG; TUNE-UP, ENGINE.

▼ *Non-magnetic feeler gauge measures air gap between the pickup and reluctor lobe.*



Lighting above the windows lends a cheery atmosphere and highlights the curtains.

How to Plan Kitchen Illumination

Is your kitchen a safe, appealing place to work, or is it boring, difficult to use and dangerous? Lighting can make a difference

THE ULTIMATE IN KITCHEN beauty, efficiency and safety is achieved only if a basically well-designed room is properly illuminated. The lighting problems must be studied carefully during early stages of kitchen planning because the very best use of fixtures may call for architectural modifications of initial designs.

The casual manner in which many otherwise fine kitchens are lighted suggests that there is widespread misunderstanding of the functions of kitchen lighting. It must do more than merely help find the sink and refrigerator.

The primary consideration should be that of safety, because the kitchen is the second most hazardous area in a home. Over ten percent of all falls in the home occur in kitchens. Sharp utensils can cause serious cuts. Hot pans and spilled grease can produce severe burns. Electric cords dropped into unseen puddles of water create shock hazards. Good illumination can greatly minimize these hazards.

The second function of kitchen lighting is to maximize work efficiency. Proper lighting creates a cheerful atmosphere that encourages good work habits, eliminates unnecessary fumbling in dim lit cabinets, and discourages the toleration of cluttered work areas.

Thirdly, lighting has a profound psychological effect on people. Poor lighting increases nervous tension, fatigue and frustration. Flat, uninteresting lighting increases boredom because it fails to satisfy an innate need of stimulation and variety. Large shadowy areas convey gloom and depression. On the other hand, carefully planned

illuminator: see photomicrography
impedance: see electronics
indoor furniture: see furniture, indoor
indoor gardening: see fluorescent lighting
inland boating rules: see navigation

lighting creates a psychologically relaxing atmosphere, while simultaneously providing ample illumination for work. To be efficient, a kitchen need not—in fact should not—be over-illuminated to the point where it begins to resemble a hospital operating room; kitchen surgery of roasts can be performed in more pleasant surroundings.

Every kitchen needs two basic types of lighting: general illumination for walking about, seeing into cupboards, and to create

White satin-finished globes in floating frame suit starkly modern decor. Four 100-watt bulbs fill the bill well; provide general illumination.

As shown here, ceiling fixtures can be decorative as well as functional. The hinged diffuser facilitates lamp replacement.

an overall cheerful atmosphere; and local illumination to make work areas more efficient and to add interesting variety to the otherwise flat light provided by the general illumination.

Fluorescent lighting. Undeniably, fluorescent lighting is preferable to incandescent light in most kitchen applications. The light is softer and more diffuse, hence less likely to create disturbing shadows. Fluorescent lamps supply more than three times the light output per watt than do incandescents while generating much less heat—an obviously important advantage in the kitchen. Finally, the tubular shapes of fluorescent lamps are ideal for spreading the light along counters.

You should choose fluorescent lamps having the best "color temperatures" for your particular needs. Natural white provides the best general color rendition in the surroundings, and makes food look natural and wholesome. Warm white lamps are best for warm color schemes, especially if the walls and/or cabinets are of wood. Cool white lamps should be used only with cool-toned decors.

Be careful about mixing lights of differ-

➤ *Dark cabinets, walls and counters need strong lighting for quiet charm, rather than a somber effect.*

ent color temperatures, especially if you use warm incandescent lights for some applications; in this case stick with the warm fluorescents for better blending of the light. Incandescent lights are generally used singly or grouped where more or less directional lighting is needed, in range hoods, and in fixtures that illuminate dining tables. They are not usually applicable to structural, valance, cornice, wall bracket or luminous ceiling installations.

Fluorescent lights have many more applications. They can be stretched along the tops of open-to-ceiling cabinets, or placed in soffits in front of cabinets that reach the ceiling. The soffits should be 8 to 12 inches deep and about equally wide. In such applications they help ceiling fixtures in the distribution of general lighting. Ceiling fluorescent fixtures should provide about one watt per square foot of floor area, or

➤ *High-fashion overhead octagon, the strong punch of downlight over sink, oil lamp for informal dining are all noteworthy.*

▲ *Overhead fixtures effectively illuminate beautiful cabinetry or contents. Light dimmers might be considered for possible advantages.*

about five watts per square foot in the case of luminous ceilings.

Luminous ceilings tend to enhance the spaciousness of a room by providing perhaps the ultimate in shadowless illumination. But a ceiling of this kind can be expensive. Also, you have to start with a room that has a higher-than-average ceiling so that the light diffusers can be dropped down about one foot. A partly luminous ceiling is sometimes a good compromise between light distribution and economy. Lowering of the ceiling can be avoided by building the light units into the spaces between the ceiling joists. Installation instructions for both types of luminous ceilings are available from equipment manufacturers.

Work area lighting. The most effective lighting for various kitchen work areas is largely dependent on the architectural details of the room. For example, if a sink or range area has wall cabinets on each side, and these are joined at the top by a faceboard at least eight inches deep, a two-lamp (30-watt) fluorescent fixture mounted close to the faceboard will provide good light for the work area. A three-tube fixture should be used if short-length 20-watt tubes are required because of limited space. The lamps should be left bare to obtain maximum illumination. In a similar place, incandescent lights could consist of two 75-watt floodlights spaced 15 inches apart; or recessed spots of equivalent light output can be mounted on a soffit, about three or four inches behind the faceboard.

If the sink or range area has no faceboard, the two 75-watt incandescent floodlights should be in louvered "high-hat" fixtures. Surface-mounted incandescent lamps should be in metal housings that eliminate glare. Fluorescent lights, whether recessed or surface-mounted, should have shielding consisting of louvers, frosted glass or ribbed clear plastic. Since the shields will reduce light transmission, use specular reflectors behind the tubes to throw more light downward; they will nearly double the available light.

Fluorescent lights can be attached easily to the undersides of wall cabinets to illuminate counters. Preferably, place the fixtures near the front of the cabinets, using opaque shielding to keep direct rays from the eyes. Though not as good, the fixtures can be attached to the rear wall, directly under the cabinets. In each work area, use the longest tube that will fill at least two-thirds of the counter area; you may have to string two or more lamps in a line to properly light long counters.

Peninsula counters that have overhead

cabinets are treated in the same manner except that opaque shielding is required on both sides of the fluorescent tubes. If there are no overhead cabinets, use louvered, surface-mounted, semi-recessed cylinders; or 75-watt "high-hat" recessed floodlights spaced 20 inches from center to center.

A ventilating hood over a range should have provision for a single 100-watt bulb, or two 60-watt bulbs.

Bear in mind that the lighting specifications recommended here relate to a kitchen having a generally light or medium-toned color scheme. A kitchen having dark walls

The beauty of wall tile is accentuated by fluorescents below cabinets. Framing of overhead fixture complements the cabinets, too.

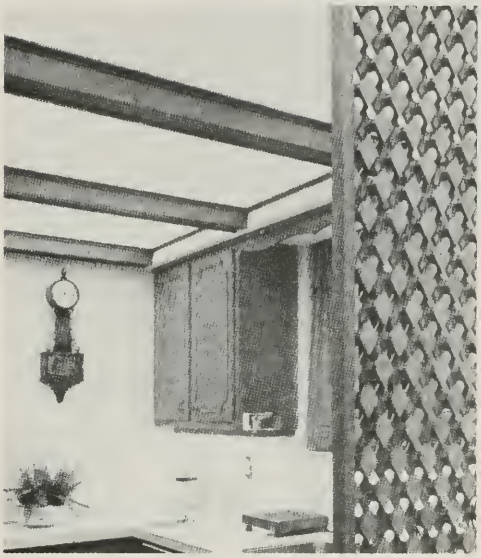
and cabinets will require more general illumination to keep the room from looking too somber. If countertops are very dark, more light may have to be poured onto the work areas to make them truly efficient. Remember that much of the light that hits a counter is bounced upward and is reflected downward again by the undersides of the wall cabinets. If the counters are very dark, hence highly light-absorptive, the benefits of such bounceback are lost; you must rely almost entirely on direct illumination. Kitchen designers sometimes suggest black countertops because they provide smart styling in the right room; but lighting experts are more likely to favor light- or medium-toned counters because illumination problems are minimized.

Dim for mood. Consider the possible advantages of using light dimmers in your kitchen. How will you use the kitchen dining area? Will it also be used as a work area—perhaps by children at play or doing school work? Will it be used as a sewing area? If so, you need plenty of overhead light to avoid eye strain that leads to unnecessary fatigue. Where you dine, or when you are enjoying a quiet midnight snack, a much lower level of illumination can be relaxing. You can have both if the table fixture is controlled by a dimmer switch.

A number of practical dimmers are now on the market. Full-range solid-state dimmers that will fit into a wall switch box can handle loads up to 600 watts and provide any amount of light output from zero to

➤ *Note the warm, white fluorescents in the ceiling. They can be dimmed for leisurely dining. Early American hanging lamp over the table was added primarily as decorative touch but reduces commercial aspects of dining niche.*

Proper illumination can make what would be just a kitchen work area into a comfortable, warm room. In addition to beauty, consider vastly increased efficiency of food preparation when light is spread over entire work area.



almost full brilliance. Larger control units that can be mounted separately from switches in 2x4 stud wall spaces can handle greater power loads; however, they are not likely to be needed in the average kitchen.

Fluorescent lamps can also be dimmed effectively but they require special dimming ballasts, three-wire connections and grounded circuits for best performance.

So if you add the idea of "timelessness" to the desirable objectives of planned kitchen lighting, the complete formula for success then becomes: Beauty, Efficiency, Safety and Timelessness. The acronymn, you will note, is BEST.

See also: DIMMER, LIGHT; FLUORESCENT LIGHTING; KITCHENS; LIGHTING.

GENERAL KITCHEN LIGHTING GUIDE

Kitchen Size in Square Feet	Ceiling-Mounted or Suspended Fixtures (watts)	Non-directional, Recessed Square or Rectangular Boxes (watts)
Fluorescent:		
Under 75 sq. ft.	60 watts	Two 40 watt
75 to 120	60-80	Two 40 watt
Over 120	¾ to 1 watt per sq. ft.	Two 40, or three 30, or six 20 watt fixtures per 60 sq. ft.
Incandescent:		
Under 75 sq. ft.	150 watts	Two 150 watt
75 to 120	150-200	Four 100 watt
Over 120	2 watts per sq. ft.	One 100 watt per 30 sq. ft., or one 150 watt per 40 sq. ft.

See text for structural, cornice, wall bracket and luminous ceiling lights.

These two inlaid veneer scenes were made by the patch method, in which layers of veneer patches mounted in cardboard sheets are stacked so each patch of veneer occupies the same position it will have in the picture. The design is transferred to the top of the stack and then the whole stack is cut out on a jig saw.

How to Make Inlaid Veneer Pictures

It's not as difficult as it looks to make pictures of inlaid wood, and the most expensive tool you'll need is a power jig saw capable of accommodating fine blades

INLAID PICTURES arouse special interest because of their neat appearing joints and colorful play of wood-grain figures that fill the simple outlines with detail. With over one hundred varieties of veneers to choose from, and an endless array of grain combinations including curls, blisters, burls, crotch patterns, and contrasting stripes, it is possible to get textured effects in the picture. A power jig saw capable of mounting fine blades will take care of needed machine work. If you do not care to make your own designs and assemble the materials, kits are available containing patterns and necessary duplicates as well as veneers suitable for the pictures.

The padding method is the commonly accepted way of making single copies of inlaid pictures, and if the extra expense is not minded, the stack can consist of entire sheets of the chosen veneers together with the blinds, or top and bottom boards. But in this simple method the flow of grain can be controlled only to a limited extent unless a separate veneer is included for each part having a special grain direction, which might make the pad too thick. Consequently, the pad is better laid up by the patch method, in which oversize pieces of veneer are sunk into pockets cut into cheap veneers or cardboard, thereby reducing the number of plies required, as well as the number of veneers needed.

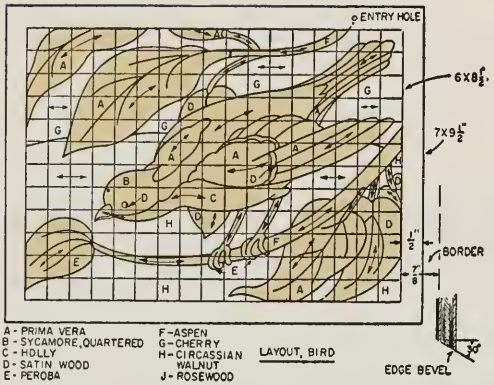
The inlaid landscape illustrated by photos and drawing was made by the patch method. A description of its construction illustrates the principle for all such work. First copy the drawing on paper marked

insecticides: see fertilizers
insects: see pest control
insulate your basement: see basements
insulating windows: see windows
insulation, home: see heating systems, home

with ½-inch squared lines and then make a careful tracing of the drawing on transparent paper. As this sheet will be used for exploring the color and grain configuration of the veneers, you may prefer to ink the outline on heavy cellophane material, for greater transparency. Having chosen a grain that follows the direction of the part, for example, lengthwise of a stem, or interlaced as in burls for masses of foliage—hold the pattern firmly at one side and slip a piece of carbon paper under it. Trace the part onto the veneer, using a stylus. Mark out all of the other parts on their veneers in the same way.

For layers, use cardboard which is easier to obtain than inexpensive veneers and easier to handle. The tendency of cardboard to choke the blade is negligible if the jigsaw teeth are well spaced. Most breakfast cereal boxes are made of cardboard of a suitable thickness to match the veneers. Cut a rectangle for each layer, allowing a ½-inch nailing margin all around. On each card trace off the outlines of the parts they are to carry, using the transparent tracing to locate them. Remember that two touching parts cannot be included in the same card. Draw a rough outline around each about ¼-inch outside the true outline, and cut out. Lay the opening in the cardboard over the tracing on the veneer, center it and run a pencil around the cutout. Use scissors to cut out the oversize piece of veneer. Work with the grain so that splits will occur in the waste material instead of the usable veneer. Slip the pieces of veneer into their openings and secure with strips of masking tape ½-inch wide, placing the tape along the joints. The crisscrossing of grain in this pad build-up prevents tendency of the blade to run off the line by following the grain.

As little veneer would be saved by cutting out for the leaves for this picture, a single piece of cherry veneer was taped in for the sky pieces and Circassian walnut for the ground pieces, each in its own card.



Pattern for sawing out the bird picture. The arrows on the pattern indicate the grain direction for the veneer patches in the stack.

On No. 1 card the breast of the bird, the leaf at lower left and the front leaf lower right were taped in, besides the sky. No. 2 layer included the ground, upper left leaves, the upper end of the leaf behind the bird, and the bird's tail. In a like manner the other cards were assembled. To stack the cards, align them, and tape together around the edges.

On a piece of ⅛-inch whitewood or balsa, cement the original pattern and stack it with the cards. Use a similar piece for the bottom of the stack. Drive ½-inch brads, or carpet tacks if balso is used, from the underside through the margins, spacing them about two inches apart, and clinch on the top piece across the grain of the wood.

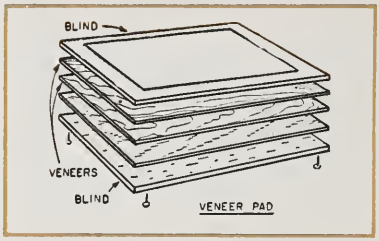
Since the saw kerf appears as a line around all cutout parts, a fine jig saw blade should be used. While a little heavy, the blade designated 4-A5 does good work and is quite rugged. It is .012 inches thick by .023 inches wide and cuts a line slightly more than .01-inch thick. Experienced inlayers use a jeweler's piercing blade No. 4/0, which is .009 x .018-inch, or No. 6/0

which is .008 x .016. Minimum drill sizes which make holes for admitting these blades are No. 73, 77, and 79.

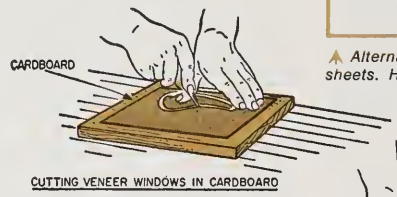
Since many of the lines come to the border, only a few entry holes for the blade are needed. To keep the nailing border intact do not saw through the edge of the pad, but start from a hole $\frac{1}{16}$-inch in diameter, drilled in the border near the lower side of the upper stem. Drill smaller holes where needed to fit the blade used, locating them in dark wood at the points of angles.

Check your jig saw to be sure that the blade is square with the table and running in a vertical line. Begin cutting at the upper border with the idea of working quickly to the center, which would be left dangerously loose if the wood around the bird were cut out first. To give starting support for the blade for resuming the main stem cut, saw along the underside of the upper stem and part way into the downward pointing stem. Back out and cut down the stem to the center vein of the leaf behind the bird. Then back up in the vein, work a turn and cut the right edge of the leaf. Continue along the back of the bird, saw the feather divisions of the tail, and then cut it out. Be sure to saw out the parts one at a time so that they will be entirely cut out before being severed from their support. Hold down small parts with a pointed stick while they are being sawed.

When a piece is cut out, stop the saw,

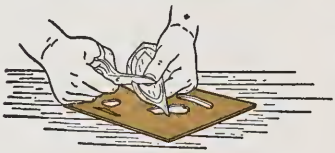


▲ *Alternative to patching. Stack whole veneer sheets. However, it can be expensive.*



CUTTING VENEER WINDOWS IN CARDBOARD

TAPING PAD



CUTTING VENEER PATCH

TAPING VENEER IN CARDBOARD

PASTING OUTLINE ON TOP BLIND

Sawing a stack. Steady very small parts with a pointed stick when cutting them out.

Checking the fit of the pieces.

lift the hold-down, and pick out the piece. Some workers collect these fragments in a box and assemble them later like a jigsaw puzzle; but a safer way is to stick them upside down with rubber cement on a sheet of heavy craft paper. Push the pieces together, remembering that saw kerfs are present and must be divided up, otherwise joints will be tight in some places and prominently separated in others. Clamp the sheet between two boards, using the edge of the upper one to guide the saw in trimming the edges straight and square.

For the picture backing, select a piece of 5-ply ⅜-inch thick plywood. Coat it rapidly with white plastic glue and place the veneer picture, paper side up, on the backing pressing each piece with your hands. Cover with a pad of newspapers to allow for varying thicknesses of veneer, and a piece of ¾-inch plywood. Clamp at the center first, then around the edges after the glue and bubbles have been forced outward. After allowing the glue to set for at least an hour, remove the clamps and clean off the craft paper by peeling and rubbing with a rag soaked in rubber-cement thinner. (*Caution: it's flammable.*) Then scrape the glue off the backing around the border.

To frame the picture, use strips of dark veneer mitered at the corners. Cut four strips for the sides and clamp them between strips of wood with edges projecting evenly for jointing. Mark one end of a side piece with a miter, cut with scissors, and true up with a plane. Then mark and miter the other end to length, glue in place, and fit an end piece to the miter which has been left exposed by the clamping board. Holding the mitered end of the second piece in place, mark for length. Cut and glue down. Continue until all the pieces are mitered and in place. After the glue dries, trim the panel to size, beveling the edges toward the front. Some workers prefer to fit the frame members to the trimmed veneer while it is still on the paper backing. If trimming has cut the paper off, paste strips

Veneer picture's border has mitered corners.

This landscape was made by a method that produces more than one copy of a picture. Stack several veneer sheets of the same type and trace the outline of appropriate parts for that type of wood. When you saw the stack, it will yield several copies of each of the parts. Repeat the process for each type of wood used and you will have several sets of parts.

around the edges to carry the border. The picture, complete with its frame, is then glued to the backing in one complete assembly.

Since veneers vary in thickness, a good deal of the leveling of the picture can be done with a cabinet scraper. Sand after scraping with 4-0 garnet paper over a padded block and fill the joints with a paste made of jig saw sawdust and glue well worked in with a putty knife. When dry, sand with 6-0 garnet paper, finishing by sanding individual parts with the grain, holding the abrasive paper around a finger tip. Shellac and wax combine to make a good finish. Dilute white shellac with an equal quantity of thinner for the first coat. After three hours, sand lightly with 4-0 garnet paper and coat with less diluted shellac. Give a final coat of full strength shellac, paint the edges black, sand lightly, and wax.

If duplicate copies of an inlaid picture are required, another method of cutting the pieces is followed. Cut out the veneer pieces as before with ¼-inch margins all around. Paste these on chosen veneers with the grain parallel to direction lines on the tracings. The veneer must be large enough to include all parts of the picture to be cut from that wood, and as many sheets are used as there are pictures.

The advantages of this method are that duplication is easy, a dozen or more copies being sawed at one time. Also a heavier blade can be used, reducing breakage and drift, and since only one side of the cut must be true the blade can make turns in the waste wood for reversal of cutting direction. The disadvantage is that each piece must be completely cut around, and any deviation from the line means a poor fit with the mating piece. But this difficulty is not great if care is exercised in sawing. A little correction can be made in a misfit by paring with a pocket knife. This method of cutting is also adapted to making one

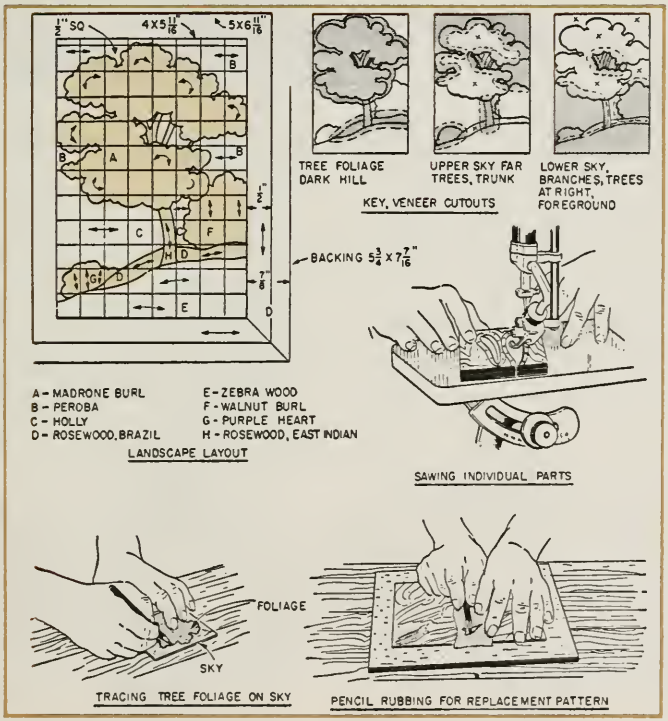
copy of a picture, and can be used with success on stock thicker than veneers. With a fine blade, a single veneer can be cut if it is first mounted on cardboard with rubber cement.

The small landscape (shown in the accompanying photo) was made by this method. After making the enlarged drawing, the first step is to make three copies by using carbon paper. Make the cutouts for pasting on the veneers, and stack the pads, driving brads all around the parts to hold them. Saw out by cutting in the waste wood while grazing the lines. Some of the hazard of this individual cutting is lessened by cutting out a key piece, such as the foliage of the tree, and tracing it on the adjacent parts. By this means only the mating parts are subject to miscutting. Assemble the parts to complete the picture as with the bird picture.

In spite of care, a piece may become damaged or lost and need replacing. This can be done after assembly, by making a pencil rubbing of the empty space and using this as a cutting pattern. Try the piece for fit, make corrections, and glue in place with a piece of waxed paper under a pressure block to simplify cleaning the patch.

M.E.

See also: CARVING; CRAFT PROJECTS; FINISHING, WOOD; HANDICRAFTS.



Make Decorative Inlaid Turnings

Create striking patterns in lamp bases, bowls, containers and other objects by gluing blocks of contrasting wood together and turning them on a lathe

Typical inlay turning work includes lamp base and (left to right) nut bowl, jewelry box, candy box and saltshaker.

GLUED-UP TURNING BLOCKS of different types of woods provide the decorative effects of marquetry for lathe work, without the labor of scroll sawing and mortising. When turning the blocks, an element of surprise is forthcoming because the effects are often unpredictable and striking in design.

The simplest type of built-up block consists of a sandwich of vari-colored woods. While the layers can be of equal thickness, those of varying thickness are likely to produce more interesting results. Since the turning blocks will be subject to heavy shocks from the turning tools, strong joints are essential, with close fits and adequate clamping pressure.

Any good non-staining glue is suitable for complicated assemblies. Avoid fast-setting glues for complicated assemblies, unless they are put together a few pieces as a time. Allow liquid glues to become tacky, and retouch places where the glue has soaked in below the surface, before clamping. When face-gluing pieces, apply clamp pressure at the center to drive out excess glue and air bubbles, then add edge-clamps.

Most inlaid turnings are built-up from four sides. The assembly for making the elliptical box is illustrated. The combinations are unlimited. The column of the lamp standard is glued-up in the same way, except that the sides are arranged swastika fashion around a core wrapped with a few thicknesses of waxed paper to be driven out after the glue is dry. The sides could be two narrow and two wide, forming a square, but the finished appearance of the sides lapping over each other at the right would be lost. Add the outer strips, and reinforce the joints with triangular mahogany strips rub-glued behind. These appear as out-croppings in the narrower lower end of the column.

To accommodate the lathe centers, plug

the ends with pine blocks nailed in. The centering must, of course, be accurate or the figures, which should be symmetrical, will be glaringly off-center. One way to center is to scribe the ends, spanning the scribers, or a compass, half the thickness of the post. Prick a small center dimple and draw a circle. If the circle is not tangent to all sides, drive the punch toward the full side and try again. Mount in the lathe and rough down.

Even this care may not put the column on true turning center. In this case nail on a fresh block and try centering again. Set in motion on the lathe, at slow speed, and press a pencil against the work. If the mark does not extend completely around the column, shift the nailed block toward the unmarked side with a clamp, and test again.

Inspite of all care, one of the narrow outer gores may show longer than the others. Since the slope of the surface is so gradual, an off center of 0.01-inch could make a difference of length of ⅛-inch or more. Careful dressing down with a mill file will bring it to length without the reduction in diameter being noticeable.

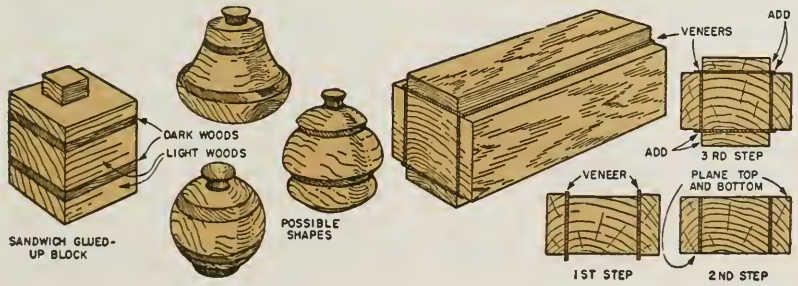
Tapered build-ups produce patterns of their own. Glue-up the wedges in one direction, dress to form wedges in the opposite direction, and assemble. Forethought must be used in planning, because if this turning were a cone with the small end at the top, the corner inlays might be cut away entirely.

Interesting effects are obtained by grooving the square diagonally and gluing in strips of contrasting woods. Turned into a cylinder, these become graceful spirals which swell in width toward the ends, where the circumference sweeps diagonally through the inlays. Obviously, an irregular contour would produce other variations. Vee-bottomed inlays or half-rounds glued into corresponding grooves cut with a molding head on a circular saw develop characteristic patterns when cut into by the turning chisels.

Still another variety of inlay is achieved with concentric cylinders of woods having different colors. Bore the cylinders with smooth-cutting bits, or by holding them in chucks. Turn the mates for light driving fits, and glue together. The cylinder thus formed can be turned immediately to fit the next larger layer. If slightly tapered, the parts can be slid endwise to secure fits. The sections could be turned as truncated cones, if desired.

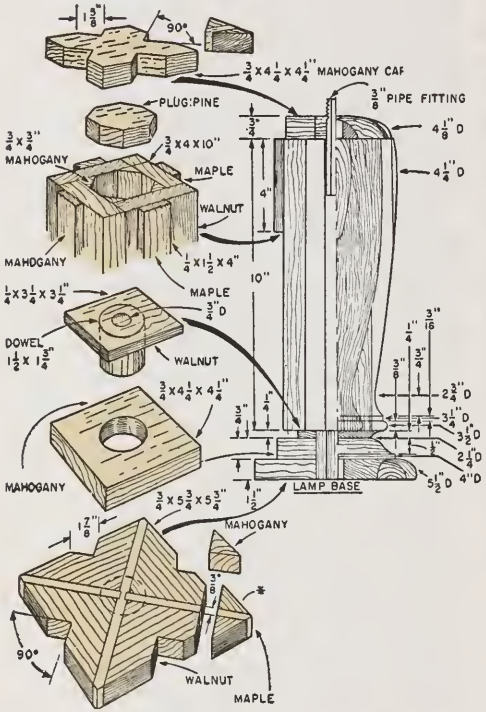
Washers of contrasting woods exhibit interesting bandings. These can be scroll-sawed as discs or sliced diagonally from turned cylinders. They could be twisted on their axes, preferably uniformly or according to some logical scheme. In the saltcellar, their slope diameters are in alignment.

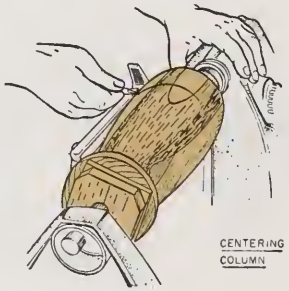
Beads or inlaid coves are made by turning a groove and inserting another color by boring a square of wood and splitting it into halves. When glued into the groove



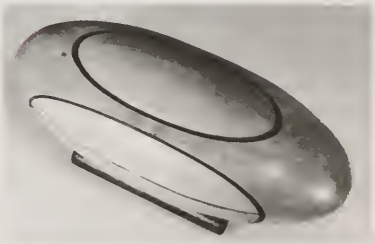
with splits joined and well clamped, glue joints are formed that can hardly be detected.

Gluing-up for faceplate work is shown



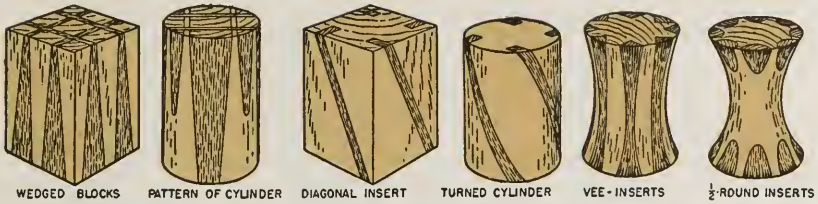


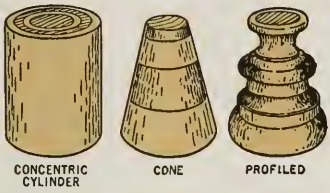
Roughing out interior of the jewelry box.

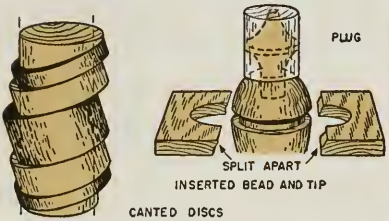


The completed jewelry box.

where the base for the lamp standard is being clamped. Here four wedges, separated by contrasting bands or inserts, are being assembled. By setting the ends of the short inserts into the long one, slipping is prevented and the wedges come into alignment readily. While the mahogany wedges could be clamped at the same time, it is usually better to assemble the others first, truing the square after drying and accurately locating the triangles to be cut out. The cap is a solid piece enriched with inserts cut from the corners of the base. As the miters present end-wood for gluing, special care must be taken to seal the pores by allowing the glue to dry somewhat before final coating and clamping. Here again,







This attractive container was turned from canted discs that were glued together.

accurate centering is required so the wedges will be the same size in the finished part.

In the base of the candy bowl, the assembly is similar to that of the lamp column. For perfect joint alignment, cut the mahogany side blocks a little wider than the core piece, and glue on opposite sides. When the glue is dry, sand off flush and glue on the other two sides. Apply glue to the surfaces and allow them to set in place a few minutes with edges aligned until the glue stiffens somewhat, so that the clamps are not so likely to slide them out of alignment. Clean off squeezed-out glue from the inside corners. It is a simple matter to glue in the walnut corner blocks afterward, and to add the outer maple strips. With these constructions and combinations of them, build-ups for trays and bowls are easily made. The candy-bowl base is suitable for faceplate turning or for working between centers.

Staved construction offers wide possibilities in turning. The candy bowl body is an example. Eight tapering walnut staves are separated by built-up strips of mahogany and maple. Cut the stave stock 5½ inches long and rip to width with the miter gage set at 4° and the saw tilted 21½°. Allow a little stock for jointing to bring the wide ends to 2⅜ inches. To trim the ends to

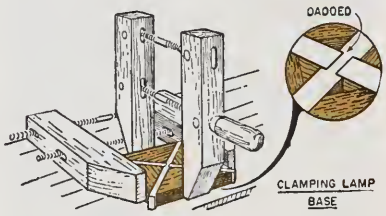
length, set the miter gage at 84° and the saw tilt 15°. Make the insert strips by ripping ⅝-inch strips across the grain of ¾-inch mahogany, gluing oversize ⅛-inch maple strips each side. When dry, joint for gluing between the staves.

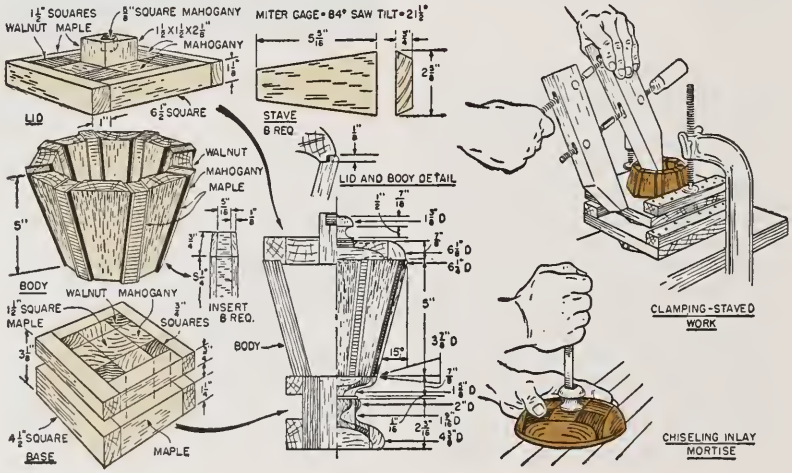
To clamp the assembly, saw octagonal holes in two pieces of 1-inch stock, sloping the jig saw table 15°, and reinforcing with strips of wood nailed across the grain. Assemble the parts inside the larger hole, press it down, and slip the smaller jig over the top. Stand the assembly on a piece of 2-inch lumber and draw down the jigs with clamps, pulling the staves and inserts out as necessary with a clamp. Even up the staves by driving them down against the 2-inch board.

When dry, sand the ends true on a disc sander and glue on a pine block for a faceplate mounting. Having screwed it to the faceplate, test for trueness by revolving at slow speed and nicking the corners with a chisel. If the top runs out, loosen the appropriate faceplate screws and insert shims under the block. With this setup, turn outside and inside, working a rabbet on the top edge for a lid.

Turn the top of the lid by inserting short screws into the inside where the holes will be turned away. To shape the inside, turn a chuck to fit the knob, letting the turned top surface seat against the chuck face. The square mahogany inlay in the knob is mortised in by boring a ⅝-inch hole and squaring it with a chisel. Turn the base and glue it to the body by centering the bowl on it and piling on weights.

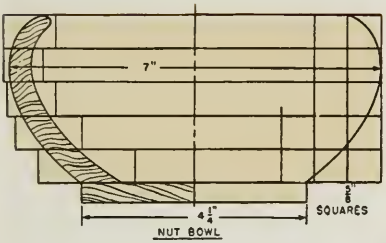
Laminated construction for the nut bowl is a means of gaining thickness but it has pitfalls because the least inequality of thickness swings the resulting circles off-center.





MATERIALS LIST

Quantity	Size and Description	Purpose
8	3/4" 2 3/8"x5 3/4" walnut	bowl stave
8	3/4" 3/4"x5 3/4" mahogany	insert stave
16	3/4" 1/8"x5 3/4" maple	insert stave
1	1 1/2" 1 1/2"x2 1/8" maple	lid core
1	1 1/2" 1 1/2"x3 1/8" maple	base core
4	1" 1 1/2"x1 1/2" mahogany	lid block
4	1" 1 1/2"x1 1/2" walnut	lid block
2	1" 1 1/8"x6 1/2" maple	lid edge
2	1" 1 1/8"x4 1/2" maple	lid edge
4	3/4" 1 1/2"x3 1/8" mahogany	base block
4	3/4" 3/4"x3 1/8" walnut	base block
2	3/4" 3/4"x4 1/2" maple	base edge
2	3/4" 3/4"x3" maple	base edge
2	3/4" 1 1/4"x4 1/2" maple	base edge
2	3/4" 1 1/4"x3" maple	base edge
1	3/8" 5/8"x5/8" mahogany	knob inlay



The stave technique was used to make the objects shown here.

For best results, build-up on a faceplate. Mount a base block and face it off, assuring a surface square with the turning center or axis. Apply glue and cover with a sheet of paper, gluing the first layer to this. Clamp on the alternate wedges and afterward fit and glue in the remaining wedges. Cut sections for the other layers wide enough to take care of the profile of the bowl. Face off the first layer, bringing it to thickness, and add the next layer of alternate blocks. This method makes the fitting of the ends comparatively easy, and the intermediate blocks can be wedged tightly by cross-clamping. Also clamp to the base. After turning, insert a chisel in the paper joint and split the bowl off. M.E.

See also: FINISHING, WOOD; LATHE.

Box at left is banded at sides with holly and topped with an inlay of holly and mahogany set in benine. The silhouette is mahogany inlaid in prima vera. Swan is pear wood inlaid in cherry.

Make Decorative Inlays

How to inlay with bands, borders and veneers; intarsia work and marquetry

As generally understood, inlaying is the art of decorating the surface of a panel with designs in contrasting colors of wood or other materials, like metal, ivory, bone, tortoise shell, mother-of-pearl, or plastics. Strictly speaking, it relates only to the mortising of one material into a ground or base piece of another material of contrasting color, a craft of great antiquity. The ornamental effect is that of a painting. Its successful application depends as much on the artistry of the design as it does on the skill of workmanship or beauty of materials.

The simplest method of inlaying is the use of strips, or bands, of wood set into the ground piece. These bands may be plain wood or elaborate strips of ornamentation built up in several colors and sold in 36-inch lengths of veneer thickness. They may be inlaid as simple lines paralleling the edges of a surface, or as elaborately interlacing bands. Guitars and similar musical instruments often carry inlaid borders called "purfling."

Plain inlay strips can be purchased so inexpensively that it hardly pays to make them. For special uses, however, the strips can be cut from veneer, using a framing square for a straightedge and a veneering saw or a knife with teeth filed in it for cutting. Clamp between boards and joint by sliding the plane on its side. The simplest method of making a groove for veneer is to use a drill press or portable power router, cutting the groove to exact width and slightly less in depth than the thickness of the band. Square the groove corners with a chisel, miter the ends of the strips and run glue into the grooves with a stick. After pressing in the bands, weight or clamp them and lay aside to dry. Then sand them down flush with the panel. If the ground is to be stained, "stop" out the bands with thin shellac accurately applied with a fine brush to keep the stain from smearing the inlay. Guide the brush by sliding your little finger along the edge of the work. The shellac is later removed in the normal process of finishing.

In designs with crossovers, interest is added by interlacing the bands. To mark pieces for length, lay them in place in the groove, the crossing member lapping over the other, and scribe the edge on the length to be cut. Unless the design is engineered to be divisible by the units in the built-up bandings, miters of the border cannot be smoothly joined.

If power equipment is not available, make the grooves with a scratch stock built as shown, using a piece of hacksaw blade for a cutter. Advance it like a marking gage, with the grain leading away from the edge

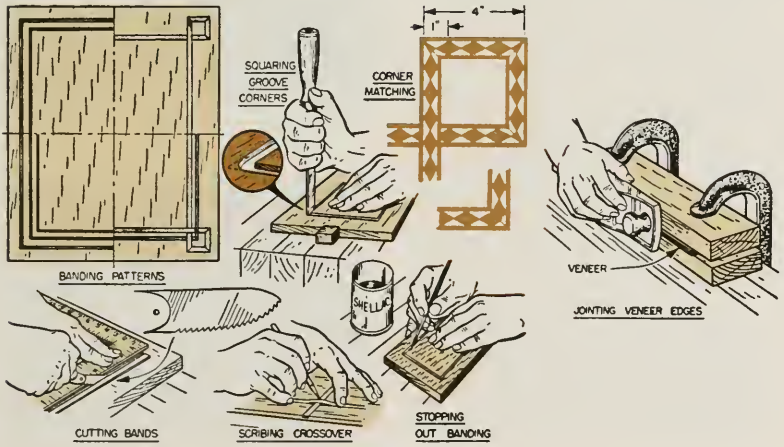
of the panel to draw the shoulder of the scratch stock against the edge. Clean out the waste between the scores with a narrow chisel, which can be ground on the tang of a file.

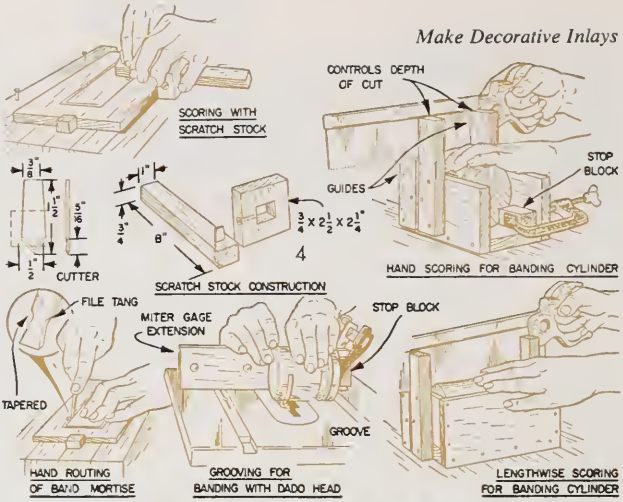
Cylindrical objects, such as turned boxes, can be grooved for banding on the lathe or with a dado head mounted on a circular saw. Rotate the box against the miter gage extension and regulate groove distance from the end of the box with a clamped-on stop block. Wrap a strip of paper around the groove to find the length of the inlay strip needed. Since a joint cannot be avoided, capitalize on it by dividing the band with vee-grooves elsewhere, making segments of equal length, alternating long with short, etc. If you do not have a dado saw, make a miter box cutting the vertical guides to such a length that the depth of cut is reached when the bar of the back saw contacts them. Chisel out the waste. A miter box built to saw lengthwise grooves for vertical banding of cylinders is also shown. Mark the divisions on the box before sawing.

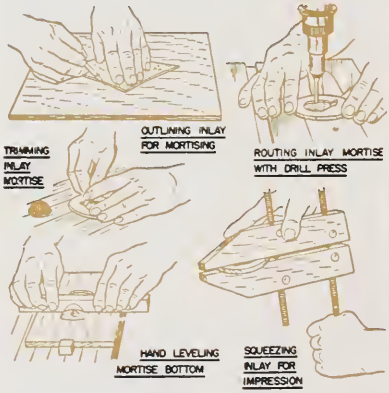
Craftsmen's supply houses offer a wide variety of factory-made inlays for centerpieces and corners, featuring vases of flowers, shell and fan designs, lodge emblems, and others in colored woods. These are about $\frac{1}{20}$-inch thick and are applied both as overlays and inlays. If linen-backed, the face side of the inlay is exposed, but if paper-backed, the reverse is true. Hold the inlay in place on the ground and trace around it with a sharp, hard pencil to outline the mortise. Rout to a depth slightly less than the thickness of the inlay, glue in place, and cover with a board for clamping or weighting. When dry, sand flush and stop out with shellac if stain is to be used.

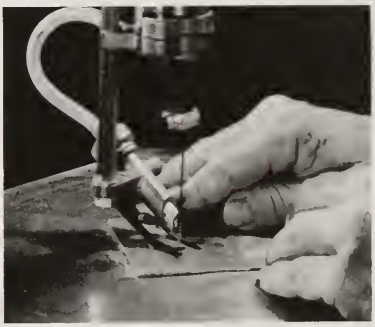
A complete inlaying job involves the cutting out of the inlay itself. A good example is the silhouette of a child's head set into a light ground. Trace the profile from a snapshot and paste on a piece of veneer or thin dark wood. Saw out with a blade about .02-inch thick and .070-inch wide, cutting the line with the blade in the waste wood and the jig saw table tilted 3° for slight undercutting.

Now trace the inlay on the ground, set up a drill press with a routing bit adjusted






OUTLINING INLAY FOR MORTISING
ROUTING INLAY MORTISE WITH DRILL PRESS
TRIMMING INLAY MORTISE
HAND LEVELING MORTISE BOTTOM
SQUEEZING INLAY FOR IMPRESSION



Cutting out an inlay piece on a jig saw.

Leveling the bottom of a hand cut mortise. To do this, drive a flat head screw into a piece of scrap so that the height of the screw in the scrap is the same as the depth of the mortise. Turn the tool upside down and use the sharp edge of the screw head to plane away the high spots in the mortise.

to cut slightly less than the depth of the inlay thickness, and work a groove about 1/32-inch inside the line. Next, excavate the mortise inside, and moving the work against the rotation of the router bit, trim the outside to the line. Trim skips by the router with a knife point, applying finger pressure over the point. If the mortise is chiseled by hand, the bottom can be leveled with the head of a flat head screw projecting from the underside of a wooden bar slid on the piece being mortised.

Place the inlay in the mortise and give it a light squeeze with a clamp. This will leave an imprint of the inlay on any remaining stock to be trimmed from the edges of the mortise. With careful paring of these impressions, the tapered edges of the inlay will wedge tightly all around upon being glued in place, making a perfect fit. Clamp and let dry. Light scraping and sanding prepares the work for finishing. Such inlaying can be repeated with other colors of wood by treating the inlaid panel as a ground.

Intarsia offers a simpler method of inlaying by stacking two veneers and sawing them at one time, producing the mortise and inlay at one cutting. By tilting the saw table, the pieces are tapered in thickness with the inlay large enough to wedge tightly into the hole cut in the under veneer. Since the veneers are thin and limber, they are stiffened by being tacked with brads to a backing of 1/8-inch basswood, three-ply, or other material. Cut the pieces 1/2-inch oversize all around, drill for brads, and nail from the bottom. Bend the points over at the top.

Checking the fit of an inlay.

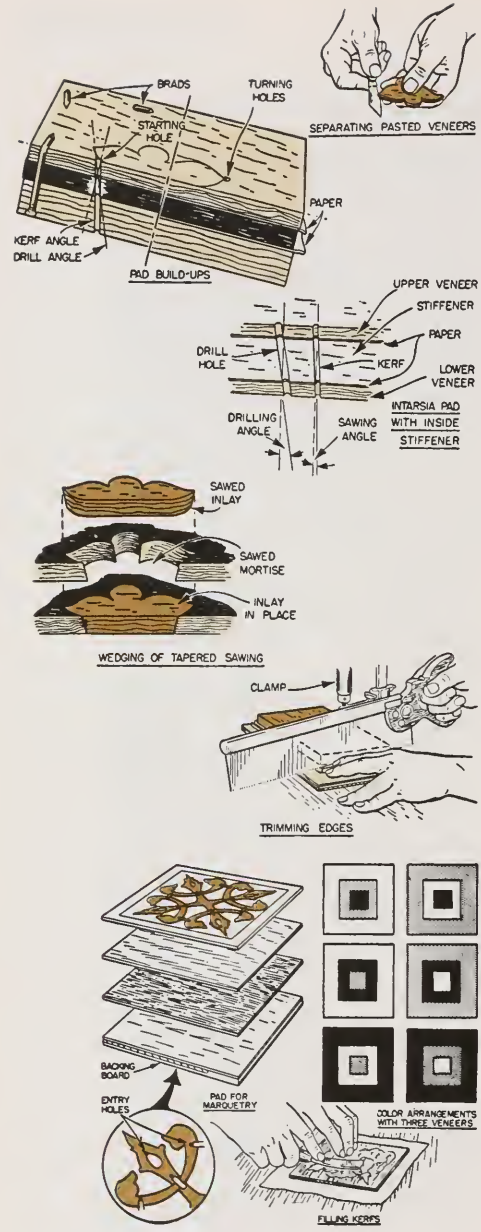
Brads can be eliminated if the veneers are glued together with paper between them; use mucilage or library paste. Apply in spots close enough together to hold all small parts. The resulting "pad" is flat, with any buckles in the veneers eliminated, thus permitting the best condition for sawing.

It is evident that with veneers 1/20-inch or less in thickness there must be considerable tilt to the table to wedge out the saw kerf, even if the blade is only .01-inch thick. The tilt is greatly reduced by padding; the veneers at top and bottom with the stiffening sheet sandwiched between. A prime material for this purpose is 1/8-inch sheet balsa, obtainable at hobby stores. Clamp lightly to avoid compressing the balsa.

The amount of tilt must be determined by trial and error, as it depends both on blade thickness and thickness of the pad. The accompanying table gives theoretical tilts for blades when veneers are of standard 1/28-inch thickness. With this as a starting point, the precise table tilt can be found by trial cutting of a sample pad.

Holes drilled to admit blades must be at least equal to their width and entered with more slope than the sawing angle, piercing outside the line in top veneer and inside in the lower. Thus, the holes in both veneers lie in parts to be discarded. Drill the holes at inside angles. If the drill press chuck will not hold fine drills secure the drill in a pin vise cut to suitable length, or in a chuck from an inexpensive hand drill held in the drill press chuck.

A good blade for sawing this pad is .012-inch thick and .023 wide. Chuck it to move in a straight line with the back guide barely touching and the holddown above, but not



touching, the work. Release the upper end of the saw blade from its chuck and thread through a starting hole, chucking it again with enough tension on the blade to hold it taut. Since the hole angle varies from the cutting angle, the blade must cut into the starting position. This can be conveniently done by turning the machine by hand for two or three strokes. Because the kerf is fine, you can make the cut directly on the line.

An abrupt change of direction, as at the tip of a pointed leaf, can sometimes be negotiated by drawing the work forward until the back of the blade contacts the wood while the turn is started. If this is not successful, drill holes at these points, at the same angle as starting holes. The drill can be a little smaller than for starting. Direct the hole along the axis of the angle to be sawed. As the pieces are cut, stop the jig saw to remove them.

If the design is elaborate, fasten the pieces on a master plan with a drop of shellac or paste, right-side up. If the designs are simple, lay them in a shallow box. With the cutting done, pull out the tacks or pry the pasted pieces apart with a knife blade. Inlay cutouts from the upper veneer are saved, while the corresponding pieces below are discarded. Assemble the parts on a flat surface, and fasten to a sheet of kraft paper or cardboard with rubber cement.

THEORETICAL TILTS FOR BLADES

Blade thickness	Table tilt, veneers together	Table tilt, veneers spaced 1/8 in. apart	Drill size per blade width
.010	15⅔°	3½°	.021, No. 75
.012	18½°	4⅓°	.023, No. 73
.016	24°	5¾°	.035, No. 65
.017	25½°	6+°	.043, No. 57

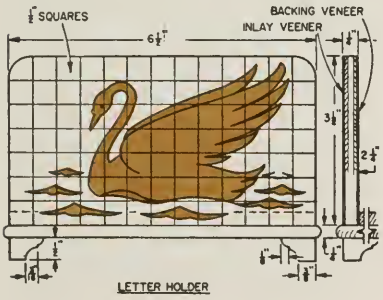
NOTE: Blades for use on inside cutting, to be threaded through holes, must be of uniform width. Wide-end blades must be cut back to teeth. In emergency a sewing needle may be used as a drill, but tends to drift.

Paste or other water glue is likely to warp the pieces out of assembly. At this stage, if bands for a border are to be put around the design, clamp the sheet between boards, aligning one end of the upper board with a border edge to guide in trimming the edges. Re-clamp for each edge cut.

Coat the panel backing with glue and allow it to stand a few seconds, then press down the assembled inlay, paper side up. To drive out excess glue, clamp the center first. A pad of newspapers between the inlay and its board will make up for variations in veneer thickness, distributing the pressure. After drying, remove clamps and boards, peel off the paper, and scrub off remaining shreds of paper with gasoline. Sand smooth and apply any needed shellac for stopping stain.

If the inlay is applied to solid wood, there is a likelihood that the drying veneer will warp the piece of wood. A veneer glued to the underside of the wood at the same time that the inlay is attached guards against this.

Inlaying in the form of marquetry consists of sawing square through a stack of veneers, usually producing several complete patterns at one cutting. Since there is no beveling, an outline equal in width to the kerf surrounds each piece. This is not necessarily a defect, as the decorative effect may be strengthened by the outline.



Since like parts are interchangeable, inlays for several panels can be cut at once, or the outside of a door can have a design with light parts on a dark ground, while the remaining pieces are assembled for the inside as dark on light.

Illustrated is a pad of three colors to be tacked or glued to the backing board. From these three cuttings, six color arrangements are possible, and three can be assembled, making use of all the pieces. More sets could be added, either as groups of the same woods or of other colors. In this design drilled holes give sawing access to all parts. If it is difficult to hold many veneers with only a lower backing board, use a top cover also.

When assembling the marquetry panel, space the pieces evenly, showing uniform edge spacing all around. Rubber cement the paper topping, turn the assembly over, and fill the joints with plastic wood or a mixture of sanding dust and glue, working it in with putty knife.

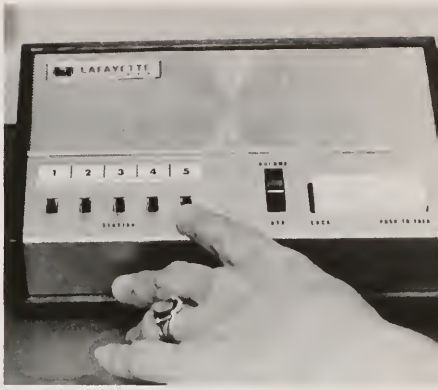
To economize with expensive veneers as well as to facilitate grain direction, small parts are sometimes roughly cut out and set into cheap veneers or cardboard cut out to receive them, and entered into the pad like solid veneers. This can result in thinning the pad for easier sawing, or in allowing more copies to be made at one time. For production work, the parts may be cut out in separate pads for fitting together.

Details for making a letter holder decorated with an intarsia swan are shown. After cutting the inlay, glue it to a backing of mahogany. Rabbet the base all around and shape to the half-round fillet. Glue the sides into the side rabbets and fasten with brads from below. To make the feet, miter ¼-inch stock and jig saw the molded profiles, gluing them in pairs joined at the miters to the bottom. The original was made of inlaid pear wood in cherry. For more contrast, use holly for the inlay.

See also: CABINETS; FINISHING, WOOD.

Choosing a Home Intercom System

There is a system available to meet every home need and fit any household budget. Because you can install them yourself, the cost is kept at a minimum



ELECTRONICS MANUFACTURERS have now virtually eliminated the three basic shortcomings of earlier home intercom systems: cost, installation problems and erratic performance. You can spend several hundred dollars for a built-in deluxe system having many remote stations, a remote door answering unit, AM/FM radio and/or record player that sends music all over the house, wake-up-to-music remote units, and a complete burglar and fire security alarm system. At the other end of the price scale are modest systems costing only about ten dollars. Most homeowners can easily install a wired intercom system of the type discussed in this article; but those who dislike any kind of do-it-yourself project can settle for a wireless system that only needs to be plugged into an AC wall socket to make it operative.

Aside from the very wide choice of available systems, the most important advance in intercom technology has been the development of solid state circuitry which has led to design of compact units that can be left on constantly because of the low power consumption. Moreover, the solid state systems require no warm-up periods, as did vacuum tube intercoms; modern intercoms come alive instantly, at the flick of a switch.

Why have an intercom? For most people, a home intercom is not so much an absolute necessity as a convenience which, once it is tried, would not be given up willingly. Even in a small home, an intercom can save many steps every day and otherwise make living more enjoyable.

For example, an intercom can quickly call members of the family to the telephone or to dinner from other parts of the house or from out of doors. It can answer the front door from the kitchen or some other room (a most desirable security feature for women who are often at home alone). An intercom can baby-sit or monitor the activities of children at play in their own rooms, in a playroom or outside. And it can be a silent bedside watcher when someone is ill.

What is available. Perhaps the only real problem is deciding what kind of intercom to buy. This is a summary of the main characteristics of typical intercom systems. Contact your supplier for more detailed descriptions and specifications.

Wireless, two-station, one-channel: The simplest intercoms to set up. Just plug into your 110-volt AC electrical outlets. Messages are transmitted through your house electrical wiring. Cost depends on power and quality of construction.

Wireless, multi-station, multi-channel: As above, no wiring is needed. These multi-channel systems let you send two or three

interior house painting: see painting, house
international boating rules: see navigation
interocular scaling: see photomicrography
iron chlorosis: see gardening
iron railings: see railings, iron

separate messages simultaneously; or use one channel for messages and the other for monitoring. This is accomplished by using separate radio frequencies (channels). Cost is based on the number of remote stations and quality of construction.

Wired, inter-mix, multi-station: Uses connecting wires between stations. Simplest types use a beep tone to signal attention. A typical 2-station (one master, one remote) system can be had for a little over ten dollars. These are likely to be battery powered. More expensive systems require no beep signals, since you can talk immediately and announce whom you wish to contact. These very versatile systems can be set up as all master systems wherein any station can call any other station, or as master-remote systems wherein master units can call all stations, but remotes can call only masters. You can buy a 4-station system (one master, three remotes) for a little over twenty dollars. For a more deluxe system, figure on paying over $30 for each master and about $13 for each remote station, plus cost of connecting cables. Some systems have cables that you simply plug into the master and remote units. Master-to-master hookup cables cost about $10 per 50-foot length; 100-foot master-to-remote cables cost less than five dollars.

Wired, battery-operated: Battery-powered systems are especially good where AC power is not available. For example, put one station in your summer cottage and the other at the lake shore. You can buy a 2-station indoor/outdoor intercom for a little over ten dollars, or a telephone style 2-station unit for around $20. The telephone style is good where you may want to keep conversations private since others in the area would not be able to hear the incoming messages.

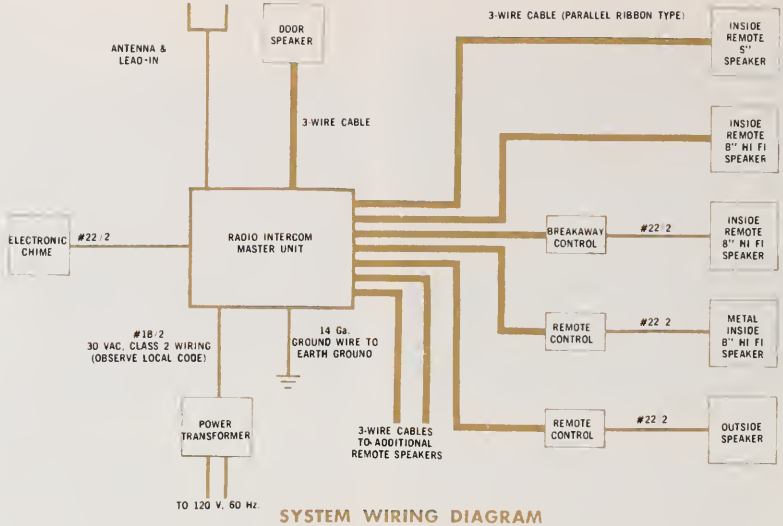
Wired, multi-function systems: Truly deluxe systems costing considerably more than these basic message transmitters can add to your living convenience and enjoyment in many ways. Some have built-in AM/FM radios so that music can be piped to all parts of the house through the intercom system. The music is squelched during conversations. Or you can hook in a record player to provide background music throughout the house. Some systems feature integrated burglar and fire alarm systems in addition to the music and message transmission systems.

Wired or wireless? Why should you even consider a wired system requiring connecting cables between the various units when a wireless intercom only needs plugging into AC outlets? Here are some pros and cons that will help you answer that question in terms of your intercom needs.

A wireless system will work only through 110-volt house circuits that are on the same phase. Thus, if your home is wired for 220 volts (you have a three-wire service lead from the street), not all house circuits are necessarily on the same phase. This means that, maybe your kitchen oriented unit will not be able to communicate with another station in the playroom or in a bedroom. Since wireless intercoms will work over distances exceeding 1000 feet when they are on the same phase and on the same side of the street distribution transformer, it is possible that you may be able to talk from your home to that of a neighbor. But this could be a mixed blessing because a neighbor having a similar intercom could eavesdrop on your in-home conversations.

Accept the fact, also, that a wireless intercom is more subject to electrical interference (static) noise from other electrical equipment, including fluorescent lights. For really clean sound, use a wired system.

An obvious advantage a wireless system has over a wired system is the ease with which any station can be moved from one location to another. A wired system must be planned very much as a permanent installation. However, we shall describe later



SYSTEM WIRING DIAGRAM

how you can easily include a roving station to meet special needs.

Planning a wired system. Before you buy equipment, decide exactly what the system is to do. Perhaps all you need is a single master, plus one or more remote stations. On the other hand, you may feel that a combination communication and music system would be worth the extra cost. If you are also thinking about installing burglar and fire alarm systems, you might simplify your problems and perhaps lower the total cost by choosing an intercom that also serves as a security system.

The system shown here consists of a master unit at the kitchen telephone table, and three remotes distributed on a lower floor—one serving adjacent laundry and play rooms, another in a photo darkroom, and a third in a home office. The kitchen master can call all remote stations, and each remote can call the master but not any of the other remotes. In this case, family living habits would have indicated that the need to communicate between the lower floor stations would be too infrequent to justify the extra expense of using more master units. Incidentally, intercom equipment designs change rapidly from year to year, so use the following installation information as a general guide, not as instructions to install the particular unit illustrated here.

Wherever you choose to locate your master control unit, try to put it near the telephone extension most frequently answered by members of the family. The individual units shown here can be placed on tables (the longest dimension is under eight inches), or they can be wall mounted using special hangers provided with the equipment. An accompanying photo shows how to mount onto a concrete wall, as in a basement location.

Cable runs. Often, the easiest way to run long leads is through the attic or along basement ceilings or beams. When drilling holes through walls and floors or ceilings, use a manual bit and brace, not a power drill which could damage a hidden power cable and perhaps electrocute you. The 4-conductor cable required for this installation is not bulky, hence it can also be run around door and window framing or along

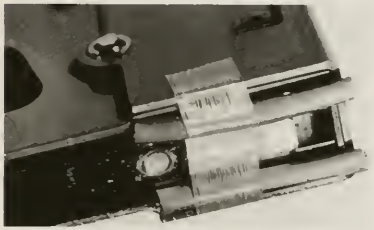
baseboards. A heavy-duty stapler can be used to attach intercom wires to basement or attic woodwork if it is modified so that the staples do not cut into the cable insulation. Just tape two short lengths of the intercom cable on either side of the staple ejector to serve as stand-offs to keep the staples from going too deep. Use at least 5/8-inch staples. By all means use the type of cable recommended by the supplier. In this case the conductors consist of twisted pairs. The twisting helps reduce crosstalk and other electrical interference in the system. More complicated systems may require the use of cable having many more conductors, in some cases as many as ten.

Chances are that you will run separate 4-conductor leads from the master to each remote. However, if the master is a long way from a cluster of remotes, or if the remotes can better be wired progressively, you may be better off using a cable having more than four conductors since one cable can then do the job of several. Note that in a radiating pattern where you have a full complement of five remotes, there are five cables and a total of 20 conductors. Place the five remotes in a progressive pattern and you will need a feed cable having 12 conductors tapped at the various locations with 4-conductor cables. The reason why you can, in effect, eliminate eight conductors by using a progressive layout is that one pair of conductors connecting to the call terminals in the master unit can be common to all remote units.

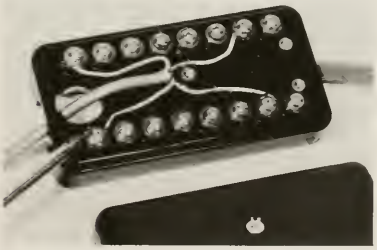
How to connect the wires. The master unit shown here has a junction box to which all cable connections are made. Do not connect to the terminals that already have wires, but remove the junction box cover to expose a similar set of unused, numbered terminals. Following the manufacturer's directions, attach one pair of color-coded wires to the so-called "C" terminals which are identified by means of diagrams. The two other conductors in the cable are fastened to terminals that relate to station call numbers on the face of the master unit.

To connect the other end of the cable to the remote unit, remove the small fiber plate on the bottom of the unit. Watching the color coding, attach the conductors leading to the master "C" terminals to the remote unit's "C" terminals. The two other conductors go onto the remaining two terminals. Do not worry about which wire goes to which terminal since it makes no difference.

The wiring description used here is to illustrate how easy it is to connect intercom units even if you must make all the individual connections yourself. Some systems now available make the job much easier because prewired cables need only



Intercom cable taped to both sides of stapler will prevent insulation damage while stapling.



Screwdriver points to one of two common terminals in junction box which are shared by one pair of wires from each remote.

be plugged into the master and remote units; it is no harder than plugging your electric toaster into a wall outlet.

To mount a remote unit on a basement concrete wall, first fasten a plywood panel onto the wall using special fasteners you can purchase at any hardware store. The remote unit is then hung onto the panel, using hardware provided by the manufacturer of the intercom unit.

When you add other remote units, follow the same procedure used to connect the first remote to the master. Just remember that all C-connected wires go to the same two terminals in the master unit's junction box, and that the two other conductors from each remote go to the paired terminals that relate to station call numbers. That's all there is to it.

The wiring of an all master system is more complex, but careful study of the manufacturer's diagrams should make even this job fairly easy.

Testing the system. Plug the power cord of the master unit into an AC wall socket and roll the volume control (which is also a switch) to almost full volume. Alternately, flick each station call slide switch to its "on" position and talk while holding down the talk bar. You should be heard clearly at each remote station. If not, recheck your wire connections. To hear a person at a remote station, you must remember to release the master talk bar while the talk bar on the remote is pushed down. Thus, each person alternately pushes and releases his talk bar to either talk or listen. If you are having a long, one-sided conversation the speaker's talk bar can be locked into place.

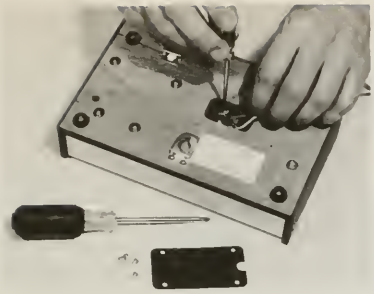
The talk bar system is used to ensure complete privacy at each station. Thus under normal circumstances the intercom cannot be used to eavesdrop on others. However, if you lock the talk bar of a remote into the depressed position, you can then listen in on that area at will by flicking on the proper station slide switch. This is especially useful when you want the system to constantly monitor a given station area—a children's play area, for example. Or perhaps you will be working down in the laundry where you may not hear the ring of a telephone or doorbell; the intercom can be set to listen in on the kitchen area to detect either sound.

Non-private wiring. You may wish to wire some stations for non-private communication. In this case the master unit can eavesdrop through the non-private stations, and persons in these remote areas can answer without operating the talk-listen bar. This would be ideal in a child's room, for example, if the child is too young to operate the talk bar properly.

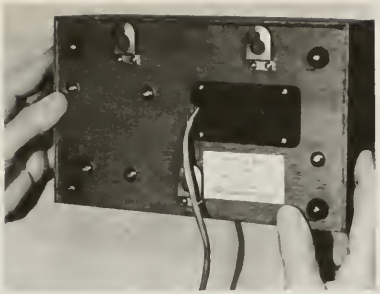
This conversion is made by adding short jumper wires to terminals located underneath the master unit. Do not confuse these special terminals (normally left untouched) with the terminals in the master unit's junction box.

Roving remote. One way to keep costs down while adding considerably to the usefulness of your intercom system is to prepare a remote unit that can be taken virtually anywhere you may want it. Perhaps you do not ordinarily need remotes in bedrooms, but you might want one when someone in the family is sick. Or perhaps you might want to put one outside when you have a lawn party so that you can communicate with someone in the kitchen. It is also ideal for the handyman who often finds that he has to be in two places at the same time. For example, when he is fixing the kitchen or bathroom plumbing, it would be great to have someone else stand by at a basement water cut-off valve and be able to talk back and forth.

All you need is a spare remote unit fitted with a long 4-conductor cable; perhaps 100 feet would be enough. When you need the unit, attach the wires to unused terminals in the junction box. To make things easier, pull a short 4-conductor extension out of



▲ *To wire remote, simply screw four color-coded wires in cable to four terminals in rear.*



▲ *Mount remote to plywood panel fastened to concrete wall with spring-type wing bolt.*

the junction box and fit it with a polarized 4-contact socket (your electronics supplier can help here). Fit the remote unit's extension cord with a matching 4-contact plug and you can have the roving remote working in seconds.

Deluxe built-in systems. More elaborate radio-intercom and radio-alarm-intercom systems are intended for in-the-wall installation (although in some cases surface mounting is possible). Obviously this type of system is best installed when a new home is under construction because the wires can be run through uncovered walls. But installation in older homes is not impractical, though it takes more time and effort to fish the cables through existing walls. Sometimes it is possible to hide wiring under baseboards and under door and window trim, or it can be left exposed —at least in difficult-to-wire areas—if you are not too fussy about the appearance.

There are two basic types of built-in intercom systems: the centralized system having selector switches on the master unit to control functions of each remote station, and the decentralized system having no selector switches for the remote stations on the master station; each remote station except door speakers) has its own function controls.

Just how convenient can a well-planned system be? Suppose you have a three bedroom home and you invest in a ten unit system. The master station might go into the kitchen, there might be remote units in the living and dining rooms on the patio to provide music as well as voice communication. In the master bedroom you have a special remote featuring a speaker/clock-timer that awakens you in the morning with music. Monitor speakers might go into each of the two other bedrooms occupied by children. A front door remote lets you answer the door without going anywhere near it, much less having to open it to strangers. Finally, by placing a remote in each of two bathrooms you can answer the door while powdering your nose, or if caught in the shower. Add a record player or 8-track stereo tape unit to provide your favorite music all around the house when you want it. More concerned with fire and intruder threats? Then consider the package which links magnetic entry-detector switches to the intercom so that a penetrating alarm is sounded if unauthorized entry into your home is attempted.

Installing a built-in system. If you plan to keep all wires out of sight, you must carefully study the way your home is constructed to find the best cable routes between the master and remote units. Load-bearing walls are often the only practical routes to use when running wires from the basement or first floor to the second floor or attic. Check the walls for locations of metal heating or air-conditioning ducts that could interfere with unit installation in the walls, or make cable

runs impossible. Homes built on one level usually are easier to wire because you can run wires through the attic or basement.

Built-in units are usually made to fit into standard walls where studs are 16 inches center-to-center. If you have different stud spacing, or if the studs are turned ninety degrees from the traditional position to form thin walls, your installation may be a mite more difficult.

Avoid putting inside units into exterior walls because dampness in such walls could cause equipment deterioration, and because you would be damaging the wall insulation. Also, do not place two units back-to-back in the same interior wall because this could lead to feedback (interference) in the reception at both stations.

The master should be in a central location (usually the kitchen) and close to the most-used telephone. In the case of a unit that doubles as a burglar alarm, the master should be within 20 seconds walking distance from the entrance so that you can turn off the alarm circuit when reentering the alarm-protected home.

A transformer is used to reduce voltage to 30 volts or less from 120 volts AC house power. This is best located near the fuse or circuit breaker box, or in a utility room or basement. Do not put it in the attic (too hot), or in a crawl space (too damp), and never cover it with insulation. Installation of the transformer must comply with the local electrical code. The transformer is connected to the master unit by a specified type of cable.

Master stations and hi-fi speakers are made to fit between, and fasten to, two standard 16-inch center-on-center studs. Built-in remote control units and 5-inch remote stations fasten directly to only one stud. If walls are not suitable for inset mounting, special frames are available for surface-mounting certain stations.

Several different types of cable will be needed. Be sure to use the types specified by the equipment manufacturer, and order more of each than you think you will need. The primary side of the transformer is connected to the house power with 14-2 wire. The secondary side is connected to the master station with 18-gauge, 2-conductor wire if the transformer and master station are within 50 feet of each other; 14-gauge, 2-conductor wire must be used if the distance is greater than 50 feet.

The type of cable you need to connect the master to various remote units depends on the elaborateness of your intercom setup. In some cases 8-wire cables must be used, in other cases 3-wire cables are adequate, and 2-wire cables suffice in still other situations. A block diagram showing a typical built-in radio-intercom wiring plan is illustrated.

No matter what type of wired intercom system you install, be sure to keep all connecting cables at least a foot away from all AC power wiring in the house to reduce hum and buzz from light dimmers and other home equipment. And do not stack or bundle remote speaker cables because this could lead to feedback interference. Whether you buy a deluxe intercom and music system, or a low cost unit that merely lets you communicate between two or more points in the home, follow the manufacturer's installation instructions to the letter and you are not likely to run into any serious difficulties.

See also: DOORBELL, CHIMES; ELECTRICITY; ELECTRONICS; WIRING, ELECTRICAL.

WHERE TO FIND IT

For more detailed information about these intercoms, consult the catalogs of such mail order radio-electronics supply houses as Lafayette Radio Electronics, 111 Jericho Turnpike, Syosset, N.Y. 11791 and Radio Shack, 2725 W. 7th Street, Fort Worth, Tex. 76107, or visit their region retail stores.

Write to NuTone, Madison and Red Bank Roads, Cincinnati, O. 45227, for information about the built-in systems.

How to Repair Steam or Dry Irons

You can check out your iron yourself, rather than call a repairman. But, remember, anything more than replacing a damaged handle or cord may cost more than the iron is worth

THE ELECTRIC IRON is a hard working appliance often used by someone who is in a hurry and expects instant results. We take its existance and rugged construction for granted.

Most electric iron troubles result from careless use or accidents. The most frequent complaints are broken cords, handles or sticky soleplates.

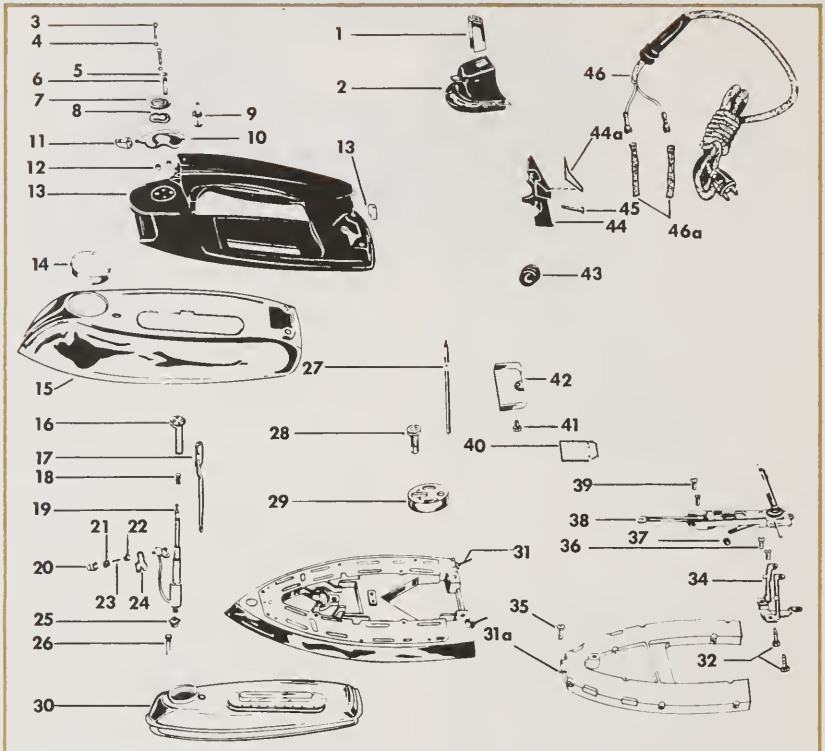
CAUTION: Before working on an iron make certain it is disconnected from the electrical outlet.

Basic service. A cord can be tested for continuity with a test light or an ohmmeter by connecting the tester to the attachment cap (plug) terminals, turning the switch on and wiggling the cord by alternately pushing and pulling it as you move your hands along the length of the cord. Any flickering of the test light or movement of the ohmmeter needle will indicate a break in the cord. In extreme cases, a visual check will show where the cord is broken or the insulation worn. A defective cord should be replaced. They are usually available at the electrical counter of your local super mart or hardware store.

A broken handle is usually not repairable and should be replaced. It must be obtained from the dealer who sold the iron or directly from the manufacturer. There are no universal replacements.

Sticky soleplates occur when the iron is too hot for the material being ironed. The

irrigation: see gardening
islander: see boat building projects
jacking: see engine
jig, lathe: see lathe



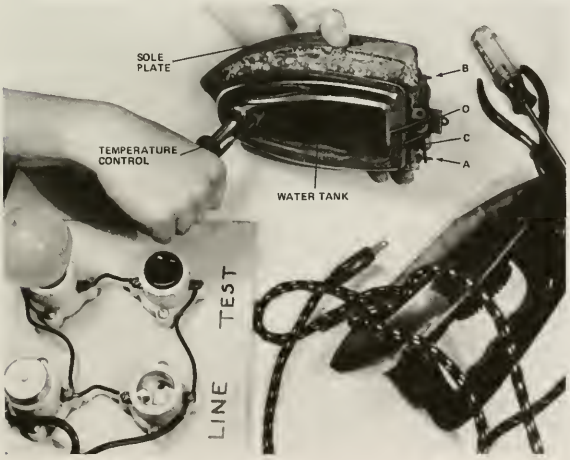
REF. NO.	PART NAME	QTY.
1	Spray Button	1
2	Steam Lever Assembly	1
3	Screw, Cam Retainer	2
4	Washer	2
5	Spring Retainer	1
6	Piston Spring	1
7	Cam Retainer	1
8	Spring, Washer	1
9	Cap Rivet	1
10	Temperature Cam	1
11	Adjusting Knob	1
12	Control Rod Gasket	2
13	Handle Assembly	1
13c	Clip	1
14	Ring, Shell	1
15	Shell	1
16	Clamp	1
17	Nut and Cam Follower Assembly	1
18	Pump Retaining Spring	1
19	Pump and Nozzle Assembly	1
20	Spray Nozzle Front	1
21	Spray Plug	1
22	Check Valve	1
23	Valve Spring	1
24	Shield Pump	1
25	Screen	1
26	Valve Stem Spring	1
27	Valve Stem and Needle Assembly	1
28	Valve	1
29	Gasket	1
30	Stainless Steel Tank	1
31	Sole Plate Assembly	1
31A	Steam Chest Cover Assembly	1
32	Screw, Handle	2
34	Bracket	1
35	Screw, Steam Chest Cover	As Required
36	Screw	2
37	Thermostat, Insulator	1
38	Switch Assembly	1
39	Screw	2
40	Mica Insulator	1
41	Screw, Name Plate	1
42	Name Plate	1
43	Circular Cap	1
44	Rear Plate Assembly	1
45	Screw, Rear Plate	1
46	Cord and Plug Assembly	1
46A	Terminal Insulator	1

synthetic fabrics are sensitive to heat and in melting will stick to the soleplate, so will excessive starch. Besides being hard to push, a dirty soleplate will soil the articles being ironed. To clean the soleplate, first try a cloth and warm water; if that doesn't clean it, (Caution: Don't try the following on a Teflon coated soleplate), use a scouring pad or fine steel wool. Don't overdo it and scratch the soleplate so as to raise a burr which can tear cloths.

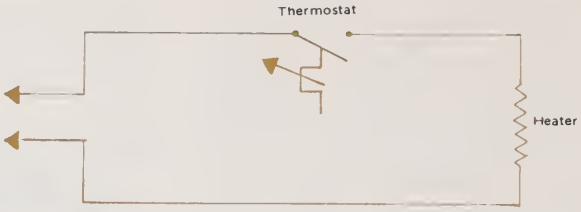
Light scratches on the soleplate will do no harm since they can't get caught in the fabric being ironed. However, nicks, burrs and other sharp projections can pull the fabric. These should be filed down to the level of the rest of the soleplate.

Steam irons. This general maintenance holds for both dry and steam irons. Steam irons have added problems due to the water used. Careless filling will cause rust on thermostat parts and using tap water instead of distilled water will allow mineral deposits to collect in the steam passages. Fortunately, most of the mineral deposit resulting from hard water usage is lime, which can be dissolved by pouring vinegar in the tank and allowing it to stand overnight. Make certain the control is in the steam position to allow the vinegar to drip into the steam chamber. The tank should be rinsed out before using the iron.

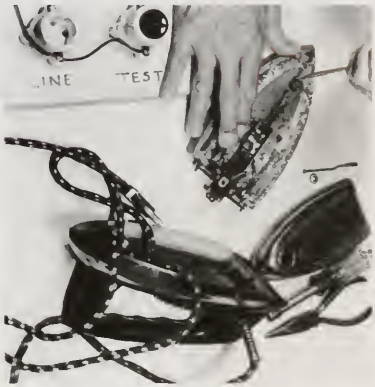
▲ *Erratic iron performance could be due to a break in the cord that opens and closes intermittently. Check for this by turning the iron on and hooking it up to a test light rig. Push and pull the cord and shake it a section at a time. If the light flickers or goes out, there is a bad spot in the cord. Usually, if there is a break, it will appear at one end of the cord or the other. If the detect is in the iron, the light will not go on under any circumstances.*



◀ *Removal of the handle and shell exposes the water tank and the sole plate and thermostat terminals. No continuity between A and B indicates an open heater element. No continuity between C and D indicates an open thermostat circuit. Any further examination requires removal of the water tank. Before removing the water tank, remember that many persons believe it is cheaper to buy a new iron than to repair anything more than a damaged handle or cord.*



➤ *Basic electric iron circuit. Some models may have a pilot light parallel to the heater.*



▲ *You can get to the thermostat by removing the water tank. The iron shown here is heavily corroded. Corrosion has disabled the thermostat, and the screws holding the steam chamber cover on are so locked in place by corrosion that they cannot be moved.*

There are two types of steam iron; the boiler type and the flash steam type. In the boiler type, the tank holding the water is heated to generate steam in the tank. This steam is then released through holes in the soleplate to moisten the fabric being ironed. In the flash steam type, the tank holding the water is not heated. Water is allowed to drip from the tank to a heated steam chamber on the soleplate, from there the steam escapes through the vents in the soleplate.

General construction. The mechanical construction and parts location of a typical steam iron is shown in an accompanying drawing. The cord can be replaced by removing a screw, rear plate, circular cap and the decal. As these parts are removed observe their position to be able to reinstall them in their original location. For example, the indicating rib on the strain relief must be up and the circular cap should be inserted with the flat surface up.

Before proceeding any further with the dissassembly of a steam iron make certain that:

1. It's necessary.
2. You have all the correct tools, test equipment, spare gaskets and silicone sealer you need.
3. You have the manufacturer's service literature for the particular model iron you are working on.

Thermostat. The thermostat maintains the soleplate heat at the temperature desired by the user. It is mounted on the soleplate so that the bimetal (temperature sensitive) unit will operate a switch to turn off the electrical current when the soleplate is hot enough, and turn the current on again when it cools off. Usually the thermostat will operate from ON and OFF through a 10% temperature differential.

A good operating temperature with the control set in the beginning of the steam position would be about 325° F. With the control in the maximum ON position (high linen), the temperature should be about 500° F. Anything over 550° F. is too high and the thermostat should be checked and recalibrated. Many thermostats have a calibration screw recessed in the control stem.

A ⅛th of a turn of this screw could make a 20° F. temperature difference. Turning it clockwise would lower the temperature. Its usually best to follow the manufacturer's instructions for each specific model.

Heating element. This is an insulated resistance wire cast into the soleplate. Three things can happen to it.

1. It can burn out (go open, no heat).
2. It can develop shorted turns (overheat in one spot).
3. It can ground to the frame (shock the user).

Heater elements are not repairable. The entire soleplate assembly will have to be changed.

The heating element can be tested with a test light or an ohmmeter. When testing from terminal to terminal of a 1200-watt at 120-volt iron, the test light will light and the ohmmeter should read about 12 OHMS. No light or no reading would indicate a burned out element. Any light or resistance reading from one terminal to the soleplate would indicate a grounded element.

Electrical circuit. The wiring diagram shows the circuit to be a thermostat in series with the heater. Usually all wiring in the iron is uninsulated bus, spot welded or silver soldered to the parts being connected.

Electrical testing. In all electrical testing, we must assume that voltage is available at the outlet and the house wiring is O.K.

The first test to make is at the prongs of the attachment cap with the thermostat turned on. A test light should light; an ohmmeter should read between 12-15 OHMS, if all is well. If the circuit is open, the next place to test is at the terminals in the iron where the cord is attached. A correct reading here would indicate the thermostat and heating element to be good, thus the trouble must be in the cord.

See also: APPLIANCE REPAIRS; ELECTRICITY; WIRING, ELECTRICAL; INDIVIDUAL APPLIANCE LISTINGS.

IRON PROBLEMS AND THEIR CAUSES

PROBLEM / POSSIBLE CAUSE	BREAK IN CORD	DEFECTIVE THERMOSTAT	CARELESS FILLING	DEFECTIVE GASKET	LEAKY TANK	CONTROL LINKAGE DAMAGED	VALVE CLOGGED	LIME DEPOSIT
DOES NOT HEAT	√	√				√		
OVERHEATS		√				√		
LEAKS WATER			√	√	√			
WON'T STEAM							√	√
STEAMS ALL THE TIME						√		
SPITS WATER		√	√					√
DOES NOT SPRAY							√	

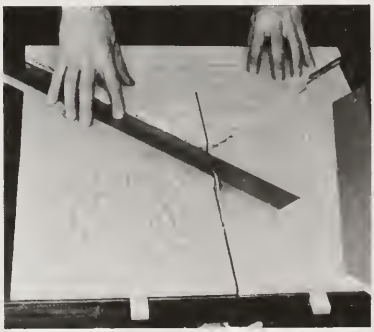
Four Table Saw Jigs to Meet All Your Needs

Get precision results in mitering, tenoning and tapering by constructing these easy-to-make jigs

THESE JIGS ARE HIGHLY VERSATILE and will probably fill your needs for everyday use. Since you are going to depend on the jigs for making accurate saw cuts, it will be worth the time and effort to make the jigs accurately.

The sliding table. This is the jig you will depend on for cutting miter joints. Once the jig is made, it will always produce a saw-cut piece at exactly the same angle and thus eliminate the possibility of an off-angle cut due to setting and resetting the miter gage you received with your saw. The chance of the stock "creeping" when making a cut with the standard miter gage is also eliminated.

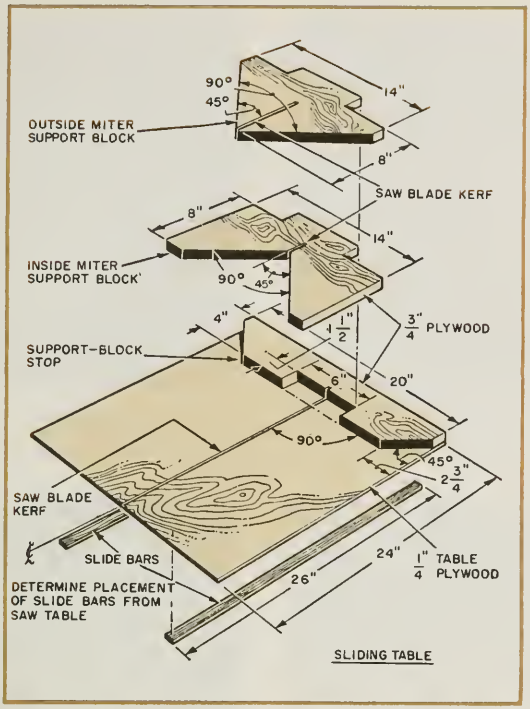
The miter jig will fit most 8 and 10-inch table saws and can be modified to suit other sizes of saws. Measure the width and depth of the miter gage grooves on your saw and cut two 26-inch long slide bars that will slide smoothly in the grooves. Use maple or some similar hardwood for these. Then cut the table or top from ¼-inch plywood and place it on the saw over the slide bars in the miter gage grooves. Since the saw blade kerf is not cut until later, lower the saw blade below the table top when doing this. Temporarily fasten the table to the slide bars with small brads to establish location, then mark their position and reassemble with glue and ½-inch nails.

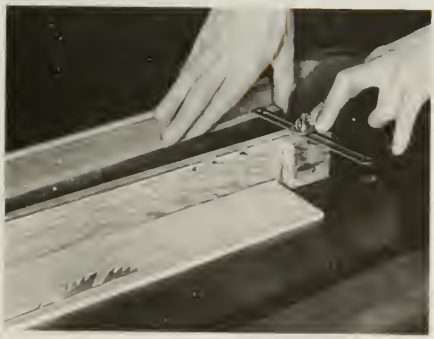


Mitering jig supports work on sliding table which permits both right- and left-hand angle sawing. Stock "creeping" is also eliminated.

Tenoning jig supports work perpendicular to saw table, thus assuring accurately cut tenons, rabbets, spline grooves and slots every time.

jogging machine: see exercise equipment
joinery: see moldings
jointing: see tool techniques
joints: see woodworking
joists: see home improvement





Tapering jig rides along rip fence making taper cutting as simple an operation as rip sawing. Taper-per-foot can be established.

Miter gage extension with adjustable stop block assures exact duplication of cutoff pieces. Prevents "creeping" when cutting angles.

You can now cut the saw kerf in the plywood table and assemble the support block stop to the table. Be sure the stop piece is located at exactly 90° to the saw kerf cut in the sliding table.

The inside and outside miter support blocks are not fastened to the sliding table so that they may be quickly set in position on the table for sawing inside and outside miter cuts when the stock cannot be flipped over. Since the 45° angle-cut edges on the support blocks must be determined from the saw blade kerfs, fit the blocks to the block stop and make these saw kerfs first; then lay out and cut the 45° edges.

The tenoning jig. This slides smoothly on the rip saw fence and will enable you to safely and accurately cut tenons and deep rabbets, mitered spline grooves and slots for "feathering."

In making the tenoning jig, be sure to measure the width and height of the rip fence on your particular saw first, and then make the fence guide pieces accordingly. Assemble them to make a sliding fit on the rip fence, or just snug enough to eliminate rocking.

When cutting the dado for the tenoning guide piece, set the bottom edge against the miter gage so that the dado will be exactly 90° with the bottom edge. Do not permanently fasten the ¾ x 1-inch tenoning guide in the dado, since it must be removed to use the splining and feathering guides. Fasten the $\frac{3}{16}$ x ¾-inch pieces to the splining and feathering guides with glue and nails, but do not use any nails within the total depth of saw cut area since this would be in line with the saw blade when making a cut.

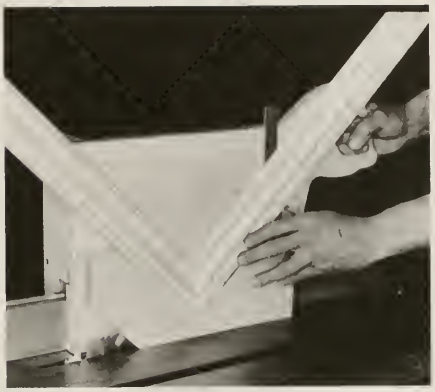
The tapering jig. This jig will hold any work piece at an angle and enable you to saw duplicate long, tapering cuts at precisely the same angle each time. By making a mark 12 inches from the hinged end of the jig, you can open it at that point to establish the taper-per-foot that the work requires. After the setting is made on the jig, you merely adjust the rip fence to accommodate both jig and work, and then proceed like you were making a normal rip cut.

If a taper is required on opposite edges of the work, you open up the jig two times the

Inside and outside miter support blocks are not fastened to the sliding table so that they may be quickly set in position.

For exact miter-length duplication of parts, cut the stock to the overall length, then lay out and miter-cut the edges.

Use straight grain, well dried lumber for tapering jig. Splining fixture supports work at correct angle. Clamp work to jig if needed.



For feathering across a mitered joint, place the mating pieces in the guide and set the blade to the depth-of-cut.

To cut equal tapers on both sides of a board, double the original setting, reset the rip fence and make the second cut.

Miter gage extension is particularly useful for making angle cuts on duplicate length pieces. Provides extra support for the work.

original setting, reset the rip fence, and make the second cut. If a taper is required on four edges, the first setting is used to cut two adjacent sides. The second setting is for the remaining two sides. Complete details for making a tapering jig that will fit any table saw are shown in the drawing. Use straight grain, well dried lumber that will not warp.

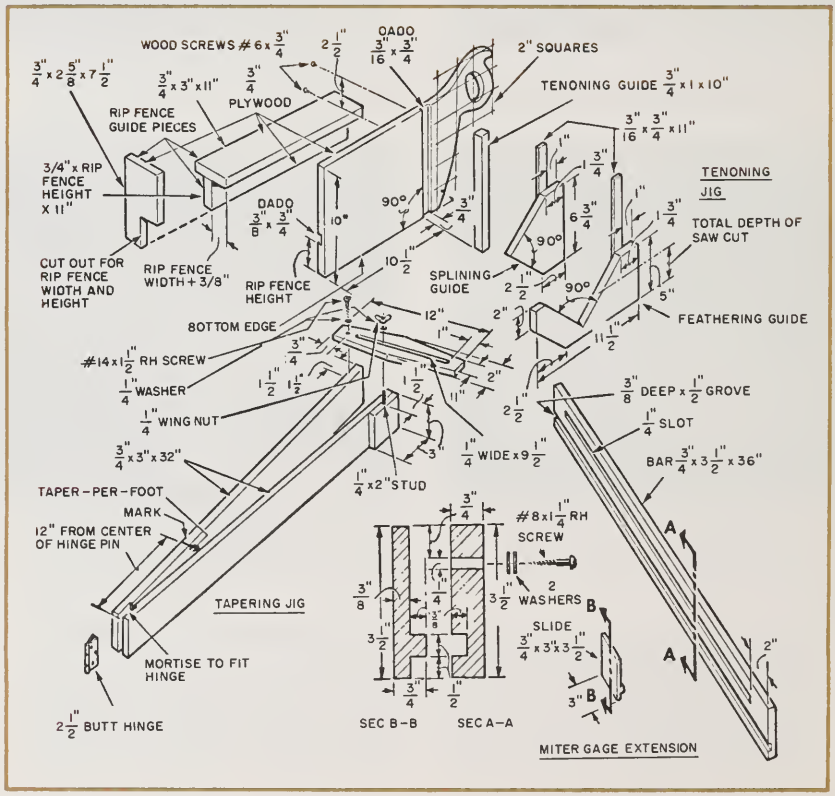
The miter gage extension. Here is an attachment for your existing miter gage that will provide both extra support for the work piece and a means of accurately making duplicate cuts to a specified

length. The extension will not interfere with setting the miter gage for angle cuts. In fact, it will help prevent "creeping" when making angle cuts because you can hold the work piece firmly against the slide stop.

Make the extension using a dado head to cut the ¼-inch slots and ½-inch groove in the bar. Turn the bar over when cutting the slot to clean out the uncut ends, and use a file to square the slot ends with the bar. Fasten the slide to the bar with a wood screw or carriage bolt and wingnut through the ¼-inch slot so that the slide can be positioned and locked on the bar. Then fasten the bar to your saw miter gage with two screws through the holes already drilled in the miter gage head.

When assembling any of the four jigs, be sure to sand smoothly all parts that will be in sliding contact with your table saw. Give the entire jig a coat of penetrating sealer and, after it has dried, sand lightly again. Then apply paste wax to the sliding surfaces.

See also: POWER TOOLS; TABLE SAW; TOOL TECHNIQUES; WOODWORKING.



Planning an Ecological Kitchen

These guidelines will help you to move your kitchen closer to the ultimate in safety and convenience

ECOLOGY IS NOW a household word that usually conjures images of horrendous environmental problems in the outside world that surrounds your home. But inside your home everything is sweetly serene and safe. Maybe. You cannot be certain until you go into the kitchen and think hard about household ecology—the way you and your kitchen environment get along together.

Yours is at least an "average" American kitchen, so it could hardly be described as a household ecological disaster area. Chances are that it needs only minor improvement, perhaps a little more extensive remodeling, to convert it into an eco-kitchen—a food preparation area wherein the family cook can work in perfect harmony with the culinary environment.

To emphasize the parallels between "outside" environmental problems and those that are encountered to some degree in most kitchens, imagine a kitchen that is in fact an ecological disaster area. There is water and air pollution because of leaky plumbing and excessive humidity and ventilation can be achieved only by flinging open a window, while noise pollution is caused because some appliances are inadequately sound-proofed and others should be located elsewhere in the home. Traffic jams and near collisions in the throughway kitchen can be attributed to the family population explosion and an influx of transients (neighbors' kids). Electric blackouts are frequent because of overloaded feeder cables. The kitchen "pavement" has dangerous potholes, and the lighting is so poor that the family cook is in perpetual danger of being stabbed by a bread knife or being "mugged" by kitchen appliances while enroute from sink to refrigerator.

How can such kitchen environmental problems be avoided or alleviated? By giving due consideration to economy, ecology and ecotone—the three basic "eco's" that cannot be ignored if your kitchen is to approach the perfection of an eco-kitchen.

Economy. Effective kitchen planning demands attention to two types of economy: financial and space. How much you can afford to spend on kitchen improvements is a personal matter, but if you have a limited budget, concentrate your purchasing power on the acquisition of quality materials and appliances and save money by cutting down on non-functional trimmings and non-vital gadgetry. There is no long-term economy in using cheap materials that wear out fast, or buying cheap appliances that break down often. You can also save on labor costs. Anyone can lay self-adhering floor tile; and those having more do-it-yourself expertise can even build kitchen cabinetry.

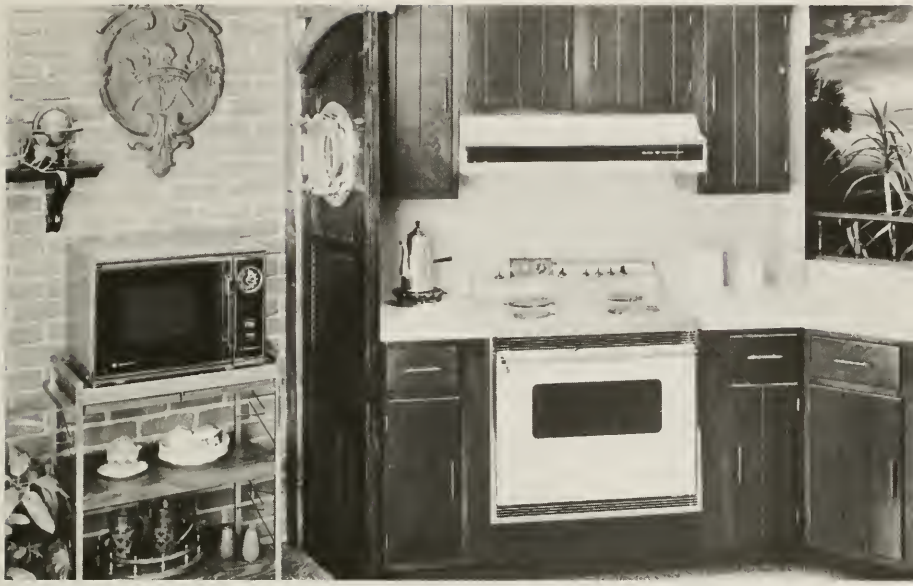
Whether you do the work yourself, or call in professional craftsmen, give primary

attention to space economy because wasted space in the kitchen is expensive space. Decide which of the basic floor plans—or variations thereof—would provide maximum utilization of all available space. Most kitchen planners view U-shaped kitchens as most efficient because they provide excellent work triangles between the sink, range and refrigerator. However, in a narrow kitchen the U-shape can be wasteful of space; more space may be lost in the two dead corners (under the counter) than is gained by adding the connecting link between the arms of the U. In a narrow space, a corridor style kitchen may be preferable because all under-counter space can be utilized for storage.

Corridor kitchens are used most often when doorways must be placed at both ends of the room. Often this is unavoidable, but if the resulting through traffic is heavy, kitchen efficiency suffers. If the second door at one end of the kitchen can be eliminated, and you wish to use the wall in a functional rather than merely decorative manner, consider installing a shallow storage wall between the counters. You would thus use the wall space most economically without robbing significantly from under-counter storage.

If the kitchen is squarish or a "fat" rectangle, rather than long and narrow, an L-shaped kitchen might be most economical of space because there might then be ample room for informal dining. If there is not enough room for a table and chairs, a peninsular snack bar might provide a

Large overhead hood minimizes water, smoke and grease pollution and helps keep the kitchen cooler by exhausting heat. Trash compactor at the end of the counter is reasonably close to the sink, although less dripping on the floor would occur if the compactor could be moved next to the sink.



▲ *Counters and cupboards that form obtuse rather than right angles facilitate work flow from one area to another. Also less under-counter space is lost than if a full right angle turn were used, but space behind the angled counter may be sacrificed.*

handy place for quick breakfasting and snacking. Add cupboards on the kitchen side of the snack bar to gain more storage space.

After making several tentative floor plans, and choosing the one that provides the best work triangle, examine the plan to spot any wasted space. For example, you may wonder what might be done to salvage the dead corner in an L-shaped kitchen, or the two dead corners in a U-shaped kitchen. If the dead spaces cannot be used economically from the kitchen side, perhaps they can be reached from an adjacent room. You might cut through a dining room wall to create a cupboard for storing table linen and place settings; or a dead corner made accessible from an adjacent garage could be used to house a hot water heater.

The rear portions of deep under-counter cupboards are hard to use efficiently. To make more economical use of such space, use drawers or slide-out shelves rather than fixed shelves.

Economy of movement is another factor worthy of careful attention. You might plan a kitchen having a good work triangle, and still be forced to move about more than is necessary. Study each work zone in relation to the operations that normally occur there. If a dishwasher is near the sink, try placing it on the side that makes transfer of dishes from the sink to the washer easiest; one arrangement might be preferable for a right-handed person, another placement might be better for a southpaw. Also, where will the dishes go after they have been washed?

Must you carry them across the room to a china or glassware cupboard, or might you be able to store them within arm's reach of the dishwasher. Such movement economies would be especially appreciated by aged or handicapped people who use the kitchen.

Try to orient all accessories used at the sink as close by as possible, and so that you need not stoop to get frequently used items such as detergents, dish mops and the like. Plan the range, refrigerator, and food mixing areas with similar attention to functional detail.

Think of the many times you normally move from the sink to the counter-top stove to turn the stove on and off. If the stove is right of the sink, you will save two steps each trip if the stove controls are on the left end of the unit. If the stove is left of the sink, its controls should ideally be on the right. It might be argued that those two extra steps are insignificant. But multiply the two steps by the number of times you make the sink-to-stove trip each week, then add all the other avoidable steps that you could eliminate by similarly judicious coordination of appliances, and you begin to see that the aggregate extra travel is worth eliminating if possible.

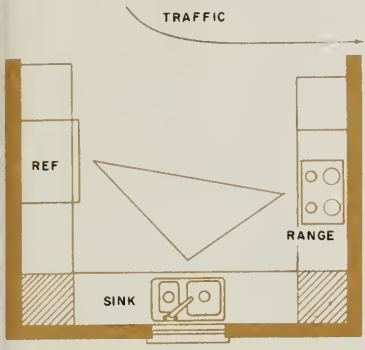
Ecology. In the popular conception, ecology pertains to environmental pollution problems and how they can be solved. But the ecologic problems are actually much broader, encompassing such other man-to-environment relationships as the psychological and safety problems created by human congestion. Very similar problems are encountered in the kitchen.

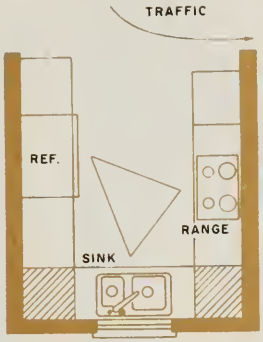
Begin with kitchen pollution. Water pollution can be of very real concern—not because of dripping faucets, rather because of excessive humidity. A humid kitchen is uncomfortable, destructive to wall finishes and appliances, and a breeding place for insects. Air pollution in the kitchen is too common to require special comment. Both water and air pollution can be controlled by use of adequate ventilation equipment, properly located. Ventilation should not be an after-thought to kitchen planning; it should be considered right from the start.

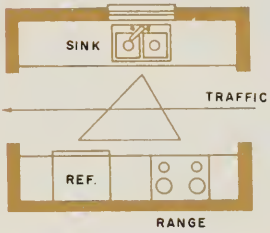
Noise pollution becomes increasingly troublesome as more mechanical devices are packed into our kitchens. Because dishwashers are inherently noisy, the better models now manufactured incorporate sound-absorbing walls and doors. But this does not eliminate all the noise. You can make them still quieter by adding sound-absorbing materials to the walls that separate the dishwasher space from adjoining cabinet space. Consult your local building supply dealer for advice about suitable sound-absorbing materials. A trash compactor is also noisy, and the problem can be minimized in the same manner if the compactor is placed under a counter.

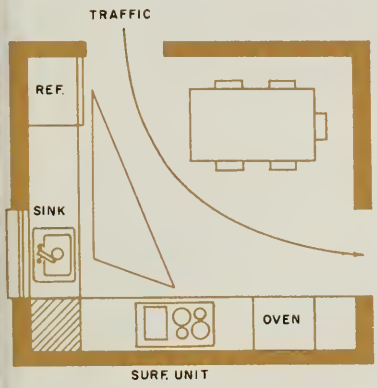
It might seem impossible to reduce the noise generated by small appliances such as cake mixers and blenders. True, you cannot stop the noise from escaping, nor can you confine it; but you *can* stop it from bouncing around the room by installing a sound-absorbing ceiling in the kitchen. Another way to make a kitchen quieter is to remove laundry equipment from the area. It does not belong there in the first place, even though some home planners argue that it is nice if you can bake a cake and wash dirty socks and underwear at the same time. If your home has no basement or other readily available space to relocate the laundry equipment, consider adding an extension to the home—behind your garage, for example.

The ideal kitchen invites no through traffic, hence a U-shaped or L-shaped kitchen is highly desirable. But as was already pointed out, a corridor style can be just as isolated from traffic if it does not have doors at both ends. If you are now planning a major remodeling job, and you presently have a kitchen door leading to the

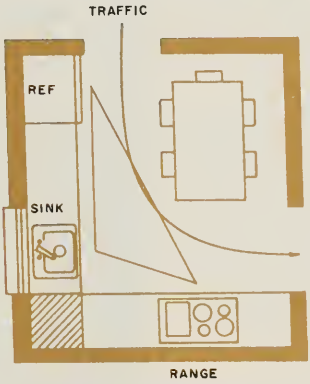


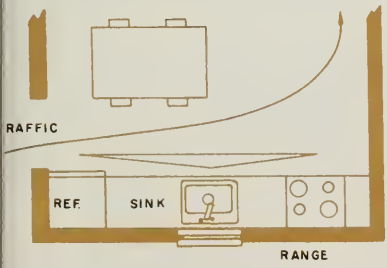


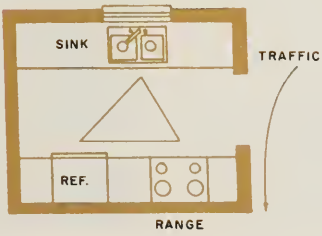




When deciding upon a basic floor plan, consider whether or not the resulting through traffic will affect kitchen efficiency.







outside or into the garage, consider the feasibility of moving the door to another location—possibly into the family room—to eliminate traffic problems in the kitchen. The kitchen would thereby become a safer and more pleasant place in which to work.

You may not yet have suffered electrical blackouts in your kitchen because of overloaded feeder lines inside your own home. But what might happen when you add that new dishwasher or trash compactor or microwave oven? Do not wait until you have finished remodeling and installed new equipment to learn whether your electrical wiring can handle the extra loads. Calculate your future power demands early and make the indicated changes or additions before you install cabinetry or finish the walls. Consult a professional electrician if calculating power requirements baffles you. Electrical blackouts—or even brownouts—are not merely inconvenient; they result from wiring deficiencies that could imperil life and property. You cannot live safely and happily in an environment that poses such constant threats.

You may not be sloppy with your bottle of olive oil, but you could have hazardous spillages of hot grease and oil because of inadequate counter space. In particular, be sure there is enough counter space on each side of the surface cooking unit to prevent accidental bumping of pot handles by passersby, and to keep them from the grasp of curious children. Likewise, provide adequate put-down space next to your wall

➤ *Compact kitchen has wall-to-wall breakfast bar and sink counter to eliminate all unnecessary traffic in the cooking area. Economy of movement is important.*

▲ *Corridor kitchen has no dead corners that waste under-counter space. Work triangles are also very good.*

oven; do not risk carrying hot, grease-laden roasting pans across the room.

No matter how expertly your kitchen is planned and built, it cannot be a safe and pleasant environment if the illumination is inadequate. Poor illumination is one of the most common faults in otherwise good kitchens. There should be general illumination provided by ceiling fixtures to keep you from stumbling over a pulled out dishwasher, bumping into an open drawer, or falling over a toy dropped by the kids. All kitchen work areas should have supplementary illumination, usually provided by fixtures under wall cabinets, to make the use of sharp knives and small appliances safer.

There are two ways to solve a kitchen litter problem. First, remove all objects from the kitchen that do not relate to meal preparation. Secondly, use all available space for storage of kitchen utensils and food supplies. Cereal boxes and food cans stacked on kitchen counters are not merely unsightly, more importantly they rob you of valuable—most probably essential—work space.

Ecotone. The transition zone between two adjacent environments is called an ecotone. In nature, one ecotone would be the transition zone between a forest and a grassland. In the home, the transition zone between two environmental entities can also be considered an ecotone. To ensure better-than-average planning of your kitchen, give thought to the transition zones that separate your kitchen from the outdoors, a dining room, the family room or whatever.

It might be handy to have a door leading from the kitchen to the back yard or terrace. But this door should not be a general family throughway. There should be an alternate route that by-passes the kitchen. If there is no choice but to use the kitchen door as a general exit and entrance, at least try to provide a buffer zone in the form of a mud-room or covered porch. Mud and water tracked into the kitchen is not only unsightly and unsanitary, but also unsafe

The kitchen can be the liveliest room in the home. A carefully planned system of cabinets, shelves, appliances, accessories and a dirt-resistant carpet can make it so. Scores of functional objects double as accessories.

because it can create slick spots that can lead to serious accidents.

An open-plan kitchen and family room should not be too open because bleed-over of play activities into the kitchen can be a nuisance, and hazardous. Provide some sort of partial barrier between the two areas to keep rolling toys from getting under the feet of the family cook.

A formal dining room next to the kitchen usually poses no serious problems, but table setting is more efficient if table linens, mats, candles and other such items are stored in the dining area rather than in the kitchen. That dead corner under a U-shaped or L-shaped kitchen counter, if made open from the dining room side, would become a very useful storage ecotone.

Another transition zone is the wall between the kitchen and an adjacent living room. Even general kitchen noises can disturb those who are reading, conversing or watching TV in the living room; and the noise intrusion would be especially annoying if the dishwasher were to be backed up against the living room wall. If you are remodeling, consider using sound-absorbing walls where necessary to minimize, if not completely eliminate, such inter-environmental noise problems.

Even your kitchen windows can be considered an ecotone. They comprise the most direct transition zone between the kitchen and the outdoors. The window area should be equivalent to at least 10% of your kitchen floor area, preferably more. You not only need adequate daylight illumination, but it should be easily controlled illumination. Will you be blinded by the glare of a setting summer sun? If so, how can you control the light? Pulling the drapes closed isn't always the answer, especially if the surface cooking unit has been placed under the window. Absurd? We know of one recently remodeled home in which the drapes must be tied back each time the stove is used. What is worse, there is no ventilating fan or hood near the stove!

A truly competent architect is not likely to make such obvious mistakes. But even the best architect cannot provide the best possible kitchen for you unless you participate in the planning and make your special needs known. And you may not know what your special needs are unless you become intimately involved in solving the kinds of kitchen planning problems discussed here. It is not particularly difficult to create a good kitchen; but it takes a lot of planning to create a food preparation area worthy of being called an eco-kitchen. J.H.

See also: ELECTRICITY; ILLUMINATION.

How to Arrange Kitchen Appliances

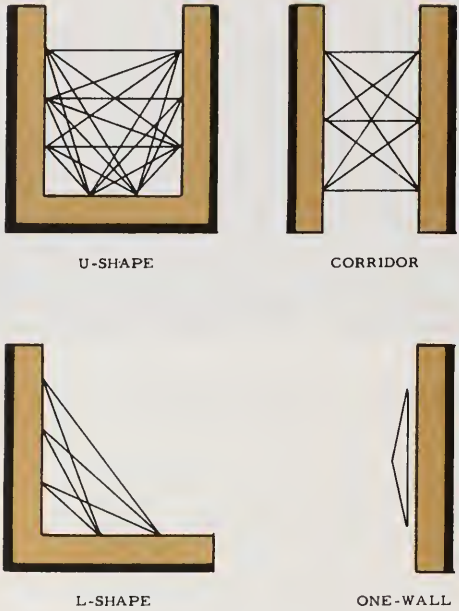
Use this guide to avoid many of the common kitchen design errors. It will help you find just the right place for each kitchen appliance

IN ANY HOME, the kitchen is undoubtedly the most difficult room to plan properly. A great many essential components must somehow be fitted together into a coherent unity displaying style, convenience and due attention to safety. The major appliances are of necessity the key elements around which all other structural components must be oriented. The ultimate creation of a flawless, long-pleasing kitchen design must start with a thorough understanding of the fundamentals of good kitchen design. But it is equally important to know where not to place the major appliances. For that reason, we will dwell as much on the don'ts as on the do's of kitchen design.

If you have engaged in even a moderate amount of kitchen planning, you probably already know that the sink, range and refrigerator should be oriented so that they form a so-called work triangle. This fundamental principle of kitchen designing is worthy of passing mention, if not elaboration. Simply stated, the work triangle represents the most used pathways between these primary work centers. Design experts have figured out that the round trip from sink to range to refrigerator and back to the sink should measure more than 13 feet and less than 22 feet, and that no one leg of the triangle (for example, from sink to refrigerator) should measure less than four and one-half feet. These limits ensure that the kitchen will be neither too crowded nor too roomy. Even if a kitchen is very large, the work triangle should conform with these basic criteria.

The work triangle plan is applicable to any shape of kitchen, whether it is U-shaped, L-shaped, a corridor plan or a simple one-wall affair. Remember that the shape of the work triangle can vary from kitchen to kitchen, as it must, so long as the distances fall within the recommended ranges. It may be difficult to visualize a work triangle for a one-wall kitchen; how-

1490 *How to Arrange Kitchen Appliances*



⚠ *Basic types of kitchen layouts showing possible work triangles. Largest number of triangles is usually provided by a U-shaped arrangement, then corridor, L-shaped and one-wall.*

⚠ *Safety factors are extremely important when locating a kitchen range. These examples show what not to do by illustrating potentially hazardous placements.*

ever, it should still be there, although it is of necessity squashed into so flat a triangle that it becomes, in effect, a straight line running the length of the work area wall.

Appliances are easiest to arrange in a U-shaped kitchen. Sketch the floor plan of a typical U-shaped kitchen, and you can readily see that a great many different work triangles can be drawn between the three available walls. This is one of the main reasons why the U-shaped kitchen design is most functional, hence most popular. A corridor kitchen, having two opposing walls, also offers considerable work triangle flexibility, though not so much as in the U-shape. The L-shaped kitchen also has two work walls, but because they are adjacent instead of opposite, fewer work triangles can be laid out. The single-wall kitchen offers least flexibility for appliance arrangement, hence it is generally used only in efficiency apartments and summer homes.

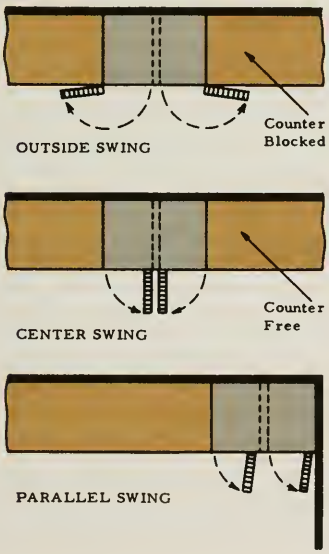
Obviously, not every conceivable work triangle would be practical. The DOs of kitchen appliance arrangement will help you discover which work triangles are practical; the DON'Ts will help eliminate impractical work triangles and possibly hazardous arrangements.

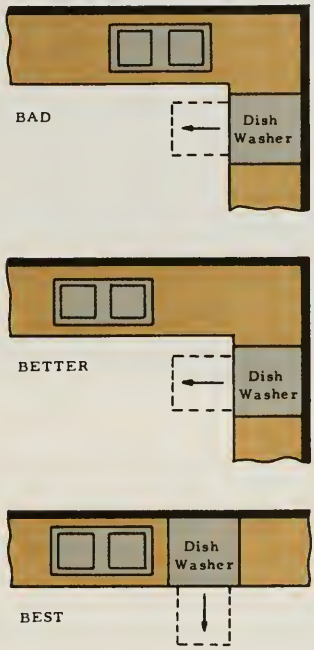
Range Locations. The cooking center (range, or countertop range plus wall

oven) is ideally located close to the dining area. There should be adequate counter space on both sides of the range or surface unit, and on at least one side of a wall oven. Since the range is potentially the most dangerous major appliance in a kitchen, safety considerations are of paramount importance. The accompanying drawings illustrate a few common range-placement errors; all are potentially hazardous, and should be avoided if at all possible.

The very undesirable cliff hanger design is achieved by placing the range at the extreme end of a counter that does not butt against a wall. This permits placing pots on the stove so that their handles project out over the end of the counter, thus making kitchen living a bit more exciting because one never knows when someone will bump into the handles and create an interesting disaster. Small children are especially likely to experiment with pot handles projecting provocatively over their heads. Safety-minded homeowners will make sure that the range or surface unit is placed at least one foot away from the counter end.

The person who has a scorched elbow range placement is easily recognized in a crowd because of wearing a Band-aid on either the left or right elbow, depending





▲ *Built-in dishwashers should be located for maximum convenience. These diagrams compare the desirability of several placements. Portable washers may also be used.*

◀ *Refrigerator door swing need not be the conventional outside swing. Other arrangements may be more advantageous in some kitchens.*

Country French corridor kitchen.

on which side of the sink the range is located. This design may also be aptly called sweat shop or sauna design because while working at the sink, you are constantly exposed to heat and steam generated by the range and cooking foods. And since it is impossible to stand at the sink while the range oven door is open, cleaning the oven offers endless sport because the oven door must be opened and closed repeatedly during the process. The scorched elbow design is found only in U-shaped or L-shaped kitchens where the counter turns a corner. To avoid this planning mistake, move either the sink or range to obtain safer separation.

Calamity corner is for those who would like an interesting blend of potential calamity with an added fillip of perpetual inconvenience. In this design, the dishwasher opens out in front of the range/oven unit. When a pot on the range boils over, or cake or roast in the oven starts to burn, you are likely to crash into the open dishwasher while leaping to control the cooking emergency. Even the not-so-impulsive must stop to close the dishwasher before rescuing the cake from the oven. If, in the illustrated case, the dishwasher were to be placed on the left side of the sink, both the calamity corner and scorched elbow sins could be avoided. Note that calamity corner applies especially to range/oven combinations, but even a cooktop would be harder to use if the dishwasher were in the way.

Usually, wall oven placement hazards are associated more with vertical than with lateral orientation. Built-in ovens are sometimes placed too high, thereby making the removal of hot pans and dishes unneces-

An L-shaped kitchen arrangement.

sarily difficult and hazardous. The oven door, when open, should be down at least at counter level. It should be even lower for short people—preferably about two inches below the elbow of the family cook. Incidentally, when a separate cooktop and built-in oven are used, the cooktop should be at one apex of the work triangle since it is used more than the oven. The oven can be nearby, if convenient, but this is not mandatory.

Refrigerators and freezers. This food storage center is best located near the service entrance to save steps when carrying in groceries that are to be stored in and around the refrigerator.

A heat-generating range or dishwasher should not be placed next to a refrigerator or freezer since the heat would greatly reduce the operating efficiencies of the cold appliances. If such placement is unavoidable, at least provide a three-inch thick insulated baffle between the hot and cold appliances.

A dishwasher is sometimes placed next to a refrigerator so that its top can be used as a counter to hold foods removed from the refrigerator. This is only partially satisfactory because such counter use is clumsy when the dishwasher is open. It would be far better to have separate counter space on the other side of the refrigerator for food handling and perhaps use the dishwasher top as a storage area for small appliances. In either case, the refrigerator door should open on the side closest to the food handling counter.

Give special attention to the way the doors on your prospective new side-by-side refrigerator-freezer will open. Usually, the

doors are hinged at the outer edges of the appliance so that they swing outward, in opposite directions. Ideally, this kind of refrigerator should have counter space on both sides. But note that if the counters are very short, they will be blocked by the open doors (see diagram).

Some models of side-by-side units offer complete door-swing flexibility because they can be made to open in any desired directions. If both doors are hinged onto the central, separating partition, they will swing back-to-back. Since no counter space would be blocked, this arrangement is especially good when the counters are small. If there is counter space on only one side of the refrigerator, consider hinging the doors so that they swing open in parallel fashion, either to the left or right as the kitchen plan demands. This type of door swing should be considered when the two-door appliance must go into the corner of a room. It could be argued that if the parallel swing arrangement is used, one door will tend to block access to the second compartment; however, this is a minor objection since both sides are not likely to be opened simultaneously. The more important positive argument is that both doors would open toward the only available counter space.

Dishwashers. A built-in dishwasher should be placed close to the sink, for obvious reasons, but it should not interfere with other appliances such as the range (calamity corner design). The accompanying diagrams show bad, better and best dishwasher placements.

The first location is clearly bad because the open dishwasher prevents full access to the sink. The second diagram shows how this undesirable plan can be improved by simply moving the sink a little further away from the dishwasher. In the indicated layout, moving the dishwasher would not provide as good a solution because the open washer rack would then be *behind* a person standing at the sink; this would be both inconvenient and unsafe. The main objection to the "better" arrangement is that the open dish rack blocks some cupboards—possibly just the place where pots and pans removed from the dishwasher must be stored.

The best arrangement of sink and dishwasher is side-by-side, along the same counter because the washer is close at hand, and does not interfere with cupboard doors.

If the kitchen plan is such that the dishwasher cannot be located adjacent to the sink, it may be advisable to use a wheelable, mobile unit. This can be rolled to the breakfast or dinner table for quick loading, then taken near the sink for the washing operation, and finally rolled to the dish-storage area for easy unloading. The only real drawback of a mobile dishwasher is that you cannot have permanent water supply and drainage connections, and the sink water outlet will be unusable for other purposes while the dishwasher is attached. The answer would be to provide a separate outlet solely for use with the dishwasher.

Counter space. No matter how well a kitchen is designed and equipped, the time often comes when there seems not to be enough counter space. This is partly due to the addition of new appliances that were not wanted—perhaps were not even available—when the kitchen was built. The obvious point is this; when building a new kitchen or remodeling an old one, build in as much usable counter space as is possible. And make sure that there is adequate counter space next to each major appliance.

But how much is adequate? Opinions of kitchen design experts differ, but as a starter consider these minimum measurements suggested by the planning department of a major appliance manufacturer. A single door refrigerator should have at least 15 inches of counter space on the

One kitchen with plenty of counter space around sinks and appliances.

open side of the appliance; a double-door refrigerator-freezer should have this much space on both sides. There should be at least 24 inches of space between the range and sink, and a minimum of 21 inches on the opposite side of the sink, and 12 inches on the opposite side of the range. A wall oven needs at least 9 inches of adjacent counter space.

If you were to build your entire kitchen to these minimum specifications, you might just get by, but certainly not enjoy working in the kitchen. Most of these measurements should be increased substantially to achieve optimum working conditions. For example, how many grocery shopping bags could you place on a 15-inch wide counter next to the refrigerator? Not many, and you would have to unload the bags directly into the refrigerator and cupboards without first sorting out like items. And what about that 9-inch-wide counter next to the wall oven? Is it large enough to take a large roasting pan conveniently? Obviously, no. Much more space would be desirable, but even 9 inches would be better than no space at all!

So far we have said nothing about large kitchens having islands or peninsulas that provide extra counter space and greater flexibility in appliance arrangement. Even in such kitchens, the basic principles discussed here pertain. The sink, refrigerator and range should form an efficient work triangle. And safety factors must be watched just as critically—perhaps even more so because the island and peninsulas are open on two sides, instead of one. In any case, whatever shape or size your kitchen may be, start your planning by locating the major appliances since these are basic to kitchen planning success.

A typical job you can do—a kitchen countertop. The tools you will need are (left to right): reciprocating saw, face shield, file, brush and roller for contact cement, laminate-seating roller, contact cement, another type of laminate-seating roller, portable router and heat gun.

Improving Your Household with Plastic Laminates

By learning this valuable technique, you can obtain a maintenance-free surface anywhere in your home. This is especially important in the kitchen

THE APPLICATION of plastic laminates to provide a maintenance-free surface is standard procedure for so many items in the average household, that the technique is one of the most valuable you can learn.

Plastic laminates are used to surface and edge countertops, bars, kitchen tables, kitchen cabinets—in fact, almost any surface where a scratch resistant, wipe-clean surface is desirable. Formica is the best-known brand, but there are many others.

The techniques for applying plastic laminates are the same for all brands and types of jobs. Tool requirements are modest and the typical home craftsman will have all of them, or suitable substitutes. Also, you need a smooth, clean surface for best results.

Applying laminates basically consists of four operations: cutting the pieces, applying the cement, fitting the laminate (which may involve bending it) and trimming the edges.

Cutting the pieces. Plastic laminates are brittle, and very hard on cutting tools. Because there is the possibility of splintering, eye protection should always be worn.

The cutting can be done with any of the following: reciprocating saw with a fine-tooth metal cutting blade; a table saw or radial saw with either a plastic cutting or carbide tip blade (always wear face protection with carbide tip blade); a circular saw with a plastic cutting blade.

You actually could do the cutting with a simple hacksaw, but this is impractical since

it would take so long that even a small job would become impossibly tedious. Also, you would run a greater risk of splintering because hand sawing is not as smooth as power sawing.

When marking a piece of laminate for cutting, always allow at least an extra eighth of an inch (a quarter of an inch is best) in each dimension for final trimming. This extra amount will also make it easier to position the laminate on the base surface.

Applying the cement. Two types of contact cement can be used; flammable and non-flammable. Although the flammable type dries faster and may offer slightly better adhesion, its use is best limited to professional shops where adequate fire safeguards and ventilation are normally maintained. The non-flammable type, when properly used, provides perfectly adequate adhesion.

The cement is applied with a brush or paint roller. The brush is recommended for small surfaces and the roller for large ones, but the choice is yours. Apply to both the underside of the laminate and to the base surface, which in most cases will be plywood or flakeboard. Make sure the coating of cement is thin and uniform.

Allow the cement to dry to the touch, which should take about half an hour if you are working in the 70-degree or higher temperatures recommended by the cement manufacturers for plastic laminate work.

Fitting the laminate. Position the laminate before it touches the base surface, for when it does, it will not budge. If you are working with a very large piece of laminate, have one person holding it at each end.

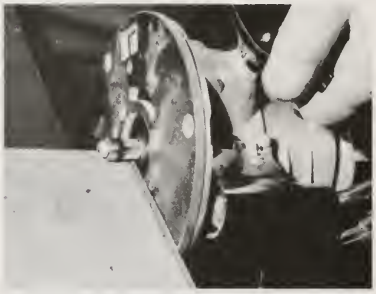
The laminate has some flexibility, so you can put it on very gently curved surfaces without special preparation. On anything but a very gentle curve, however, the laminate must be reshaped with a heat gun. There are special guns for plastic laminates, but some hair dryers or refrigerator defrosters also can be used. Test with a piece of scrap laminate, as excessive temperature (above 275°) will damage the plastic.

As you apply the heat, start the bend. You will find that the plastic soon will take a permanent reshaping. Do not worry about inadvertently gluing the plastic to your work

▲ *When surface to which laminate must be applied is other than a gentle curve, use a heat gun and carefully bend to reshape the laminate. Always experiment with a piece of scrap laminate to avoid damage to the plastic.*

◀ *Applying contact cement to the base surface, in this case to the curved side of a valance. For side surfaces, a brush is easiest to use.*

When contact cement is dry on both surfaces, simply press it down. Just be sure to position it carefully, for once it's down, it will not budge and removal is time consuming.



Portable router with flush trim bit is being used to remove the excess laminate.

Photo shows how router does its job. The router was stopped several inches from the left end to show how the excess is trimmed flush with the base surface.

bench, for the cement on the laminate will only adhere to another cemented surface.

If you work carefully, you can apply the laminate to the curved surface at one end and use the heat gun to shape a small section at a time. As soon as a section is reshaped properly press it into place and move the heat gun along.

Once the laminate is in contact with the base surface, bed it down. There are special roller tools, but a small block of wood and hammer also work. Move the wood over the laminate surface, tapping the block with the hammer.

If you err in positioning the laminate, do not try to pry it up or you will surely crack or chip it. All plastic laminate contact cements have compatible solvents, and although the job of removal is not fast, it does work if you are careful.

Start with an eyedropper filled with solvent. Apply the solvent along a joint, wait a couple of seconds, then begin to pry with a thin knife. You may only be able to get the knife in a small fraction of an inch.

Continue with the eye dropper, applying solvent into the small opening and pry further. Be very careful not to pry excessively on the laminate or it will crack.

Once you have the piece off, clean the underside with more solvent to remove traces of cement. Allow the piece to dry for half an hour and it can be re-used.

The proper sequence for laminate applications is to apply the side pieces, then trim them. Next, brush or roll cement onto a major surface, such as the top, being sure that the cement also coats the thin edges of the side pieces. Then apply a surface piece and trim it.

Trimmage. Trimming is the finishing touch, and it can be done with the port-

able router found in many home workshops. Also available are special trimmers (really types of small routers), but these are primarily professional tools. If you already have a router, do not even consider renting a special trimmer.

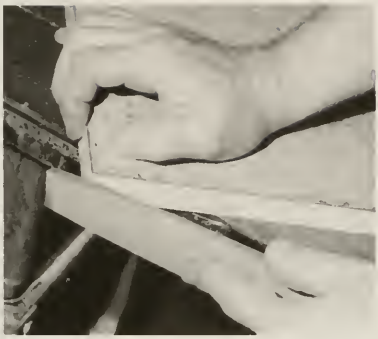
The trimming is done either flush or bevel. The usual method is to flush trim the sides and bevel trim the major surface.

You can obtain a router bit that is shaped to do either flush or bevel trimming (a compound bit), but because it does not come with a guide, it cannot be used on all types of equipment. Your best choice is a bit with a roller bearing guide built in, and this type is not available in a compound design. You will need a flush bit and a bevel bit.

Run the router along the edge as quickly and smoothly as you can, to minimize the chance of splintering. In many cases, the router trimming will complete the work. If there are some rough edges, or perhaps a deep curve or special location that the router cannot make, you can finish up with a file. Although there are special plastic laminate files available, an ordinary fine-cut file will do the job. A carbide plane is also available, but normally is not necessary.

Plastic laminate can work decorating wonders when carefully applied and trimmed to a clean, uniform dry surface. It is not, however, a nickel-and-dime material, and before you begin a major job on a surface that is doubtful, try a scrap piece in a not-too-obvious location. If filling in and sanding is necessary to get the needed surface, do not ignore this preparation. It is the mandatory first step to the final results you want.

See also: ADHESIVES; WOODWORKING.



After working with the router, a fine-cut file can be used to trim off any rough spots.

Once the sides are done, cement is applied to the main surface and to the underside of its laminate cover. Since the surface is large, a roller is convenient for cement application.

As a finishing touch, seat the edges of the lamination with this tool that has double nylon rollers. Careful use of a wood block and hammer can also do the job.

How to Replace a Kitchen Sink

Do it the easy way. Use one that snaps into place

If the complexities of installation have been holding you back from a necessary kitchen sink replacement project—fear no more. You can purchase a kitchen sink that snaps securely into place, affording the home craftsman an opportunity to do it himself with a minimum of time, tools, and effort.

Designed of stainless steel and available in a single or double-bowl model, it offers the assurance of quick, easy installation and professional-looking results, if attention is paid to a few simple but important details.

Step one is to cut the opening into the counter top 24⅜ inches long by 21⅜ inches wide with 1½-inch radius corners for the single bowl model or 32⅜ inches long by 21⅜ inches wide with 1⅜-inch radius corners for the double compartment sink.

Start 2¾ inches from the corner, fasten retainer clips to the edges of the opening, making sure that the top flange of the clip fits tightly against the top surface of the counter. Center the remaining retainer clips and then nail them into position.

Lay caulking around the counter opening.

Next, set the sink (with faucets already attached) into position with Snap-Fast clip on sink flange resting on retaining clips. Make a fist and strike a sharp blow on the top edge of the sink and—presto!—the sink will snap into position. Check the seal between the flange and the countertop and, if required, strike an extra blow to insure a proper seal.

Finally, wipe off any excess caulking and the job is done. To complete the project, a small amount of powder cleanser on a damp cloth will remove any grease and finger marks and result in a shining new sink and a job well done.

The sink can be ordered through your local plumbing dealer.

See also: FAUCETS; PLUMBING.

Countertop opening has been cut. Next, retainer clips are placed in proper position. These are then securely nailed into place.

Lay caulking around the entire edge of the counter opening. This should be done with an even flow. Excess can be wiped off later.

Place sink, with snap-fast clip on sink flange, over retaining clips. Strike the top edge to position it.

A good folding pocketknife can handle most of the cutting jobs one is likely to encounter, including skinning of small game and fish.

Choosing and Maintaining Knives and Axes

Because of the large selection of these essential camping tools on the market, you must first determine what your needs are, then keep your tool in good condition so it will help you when you need it the most

THAT ANCIENT STONE AGE craftsman who made the original axe with a stick, a stone and a length of vine probably was proud of his accomplishment. And he should have been. The tool he had created spelled progress. From that day to this the knife and axe have been constant basic tools.

Suppose you are lost in the wilderness, and survival depends upon your knowledge of woodcraft and on only one piece of equipment. What should that vital survival tool be? A sharp, sturdy knife of course.

If you are a typical camper, hunter or fishermen, the chance that you will ever face such a life-or-death crisis in the wilderness is remote albeit not inconceivable. The point is this: a good knife is one of the most useful and indispensable pieces of outdoor sports equipment you will ever buy. It follows that the purchase of a knife should be made knowledgeably, not on the basis of a hasty, off-handed decision. A good knife is a prized possession; a bad knife is nothing short of an abomination.

Shopping for just the right knife is a strangely fascinating undertaking. It is also vexatious, mainly because of the plethora of excellent knives offered by scores of reputable companies and by independent custom knifemakers. A second problem is that each knifemaker seems to have his own ideas about what materials of construction are best. If you are a novice knife user, the best solution to the problem may

be to purchase the best knife you can afford from a reputable sporting goods manufacturer offering moderately priced mass-produced knives. Chances are that you will be quite happy with your choice. If the knife is not all you had hoped it would be, take your complaints to a custom knifemaker to learn whether a handmade knife would be worth the considerably higher prices they demand.

A good folding pocketknife can handle, reasonably well, most of the cutting jobs that one is likely to encounter—including the skinning of small game and filleting of fish. Nonetheless, relatively bulky sheath knives remain popular for several good reasons. They are more efficient for heavy cutting, and for cutting bulky objects like loaves of bread. It is easier to pull out a sheath knife than to find and unfold a pocketknife, especially during cold weather when your fingers are numb or when you are wearing gloves. Sheath knives are also preferable for cleaning fish and for other messy jobs because they are easier to keep clean.

Perhaps the greatest mistake a novice knife-buyer could make is to purchase a sheath knife that is too big. A few campground swash-bucklers still argue that a seven-to ten-inch Bowie—the legendary weapon used by our frontier forefathers—is great for really heavy cutting although it should be obvious that a small axe would be even better.

Your first all-purpose knife need not have a blade longer than four inches, five at the most. Pick one having a relatively straight blade, and a comfortable feel in the hand. The once-a-year vacation camper will get along very well with such a basic knife.

If you hunt or fish you will want to consider more specialized knife designs which are available in a bewildering variety of blade shapes and sizes. Knife tips may be straight, or curved up or down. The blades may be long and narrow, short and wide, and curved in varying degrees. Many skinning knives have broad blades that have pronounced blade curvatures; some are almost leaf-shaped. The shorter versions are especially useful for cutting in tight, hard-to-reach places.

Bird and fish knives tend to be narrower than skinning or general purpose knives. Blade lengths of four inches or less are most practical unless you intend to fillet large fish such as salmon or steelhead. Some fish knives have molded-in spoons at the ends of the handles for stripping out the blood sacs that lie along the backbones of fish.

Should you buy a knife having a flat (actually wedge-shaped) cross section or one that is hollow ground? It depends on what you want in the knife and how you plan to use it. Wedge-shaped blades are made to be strong for rough use. Semi-hollow ground blades must be handled a bit more gently, but they are easier to hone to razor sharpness. A semi-hollow ground blade is actually a compromise between the rugged flat or wedge-shaped blade and a fully hollow ground blade (like that of a straight razor) which would be too fragile.

The tang of a knife is the blade extension that goes inside the handle. A full tang is one that extends all the way to the butt of the handle; a hidden tang goes only

Sheath knives are more efficient for heavy cutting and in cold weather it is much easier to pull a sheath knife out of a sheath than to unfold a pocketknife. Also, they are cleaner. Just make sure you buy the right size.

partway into the handle. Theoretically, the full tang is strongest. In practice, a hidden tang serves equally well if it is thick enough and firmly anchored to the handle, and if the knife is not abused.

Ideally, steel used for knife blades should be hard, tough (not brittle), and abrasion- and corrosion-resistant. Unfortunately there is no one steel that provides all of these desirable properties completely. Thus the characteristics of every knife blade must be a compromise between edge-holding ability (which depends on steel hardness and edge shape) and resistance to breakage. When a manufacturer claims that he uses the "best" steel, do not take this to mean that he is using the ultimate knife steel. There is no such thing right now.

Many knife manufacturers have settled on 440-C steel, the stainless alloy used to make razor blades.

On the other hand, one manufacturer uses a high-speed tool steel consisting of an alloy containing tungsten, molybdenum, vanadium, chromium and carbon. This steel, claims the maker, has durable springiness, super hardness and the ability to hold a keen cutting edge better than any other knife steel. However, the blade must be chrome plated to make it stainless, except for the actual cutting edge which will rust if it is not kept clean and dry. Lest you think that this is a major drawback, ponder the fact that many custom-made knives costing three to ten times as much will rust all over unless they are kept dry.

Pricewise there is very little difference between leading manufacturers who make mass-produced knives. They are competitive in their pricing.

The basic requirement of a knife handle is that it provides a comfortable, firm grip for the kind of cutting the knife is designed to do. There is no one handle shape that is equally satisfying to all knife

Light pruning jobs are done easily with this four-inch pocketknife with a hawkbill blade.

Pocketknives are also ideal for preparing firewood and cutting tent stakes. The knife used here features spear and pen blades, can opener, screwdriver and bottle cap lifter.

users. Additionally, the handle should be strong, resistant to corrosion and cracking, warm to the touch.

Many knifemakers place linen-case micarta (a fiber-filled phenolic resin) at the top of the list in terms of durability. But there are many other handle materials that serve very well. Imported hardwoods that have high natural oil contents make excellent handles. Brazilian rosewood, which is both durable and very attractive, is very popular. Other imported woods favored by knifemakers include pauferro, goncalo alves, and coco-bolo. Domestic woods that make good handles include curly maple, northern birds-eye maple, and osage orange.

Sambar stag handles are durable, but native deer horn is not usually recommended because of its excessive porosity. Leather washer handles—once very popular—are being discontinued by many manufacturers.

Some handles consist of a solid aluminum alloy cast directly onto the notched tang of the blade. This metal handle, including the hilt, is covered with vinyl plastic to provide a non-slip, easy-to-clean surface. No rivets, bolts or screws are used on these knives.

Another option to consider is the hilt. The hilt can stop your hand from sliding into the knife blade if you must thrust with the knife, and it may be of some help in keeping the knife securely in its sheath. But most people buy a hilted knife because they think it looks better than a non-hilted knife. The main thing again is to determine whether the hilt would in any way interfere with your normal use of the knife. For example, if you use the knife for delicate cutting—whittling for instance—a hilt could be a hindrance. To get around this, there are knives that have an extra finger notch ahead of the hilt as well as behind it so that the forefinger can be placed close to the cutting edge when making delicate cuts.

Cutting chores are greatly simplified if you take care of the edge on your pocketknife. It is important to buy a knife made with high quality steel, but that steel must be maintained.

A sheath should protect the blade, protect you, and keep the knife from being lost. The resign should be such that the knife can be removed and replaced quickly and easily.

Most commonly a sheath knife is locked in place by means of a strap, having a snap button, that goes around the handle. Some sheaths now have a strap that snaps over the hilt, or a tab that folds over the butt of the handle. If you buy a sheath having no locking strap, make certain that the knife goes in deeply and makes a snug fit. The best sheaths are assembled with rivets as well as stitching.

Fishermen should consider a knife that has a hole in the butt of the handle to which a lanyard thong can be fastened so that the knife cannot be accidentally dropped into a stream.

Knife manufacturers usually recommend that a soft Arkansas oilstone be used to hone a knife to a fine cutting edge. A fine

▲ *The many different types of sheath knives demands that you be certain of your needs. This includes size and shape of blade, shape of handle, and size of hilt.*

India stone or a silicon carbide stone may be used when more rapid cutting is needed to remove nicks and pits in the blade. A good knife should never be sharpened with a grinding wheel. Although it is not absolutely essential to maintaining a knife in good operating condition, a small sportsman's steel may be used to dress the edge of the knife between honings.

Many independent knifemakers around the country offer handmade knives of their own design and/or knives made to customer specifications. Some also provide the blade only, at lower cost, to which you can add your own handle.

Choosing a reliable custom knifemaker can be tricky unless you know someone who can, from personal experience, recommend a particular craftsman. Your best bet is to write to as many custom knifemakers as you can and study carefully the catalogs and promotional literature they provide. Look for indications of a conscientious craftsman like a clearly-stated, meaningful money-back guarantee, detailed revelation of materials used, and explanations of why they were selected, honest admission of the limitations as well as qualities of the handcrafted knives, realistic estimates of delivery times and, in some cases, even encouragement that you buy a certain type of knife from another source.

An example of a forthright statement that encourages buyer confidence is this one by a custom knifemaker: "It is not possible to make a knife that will operate efficiently as a cutting tool and at the same time chop through hard bones. If you want a knife that will chop bones and generally double as a cleaver, we can certainly build you one if you make your wants known, but please do not expect such a knife to slice through hide and meat the way our regular models will. Better yet, let us build you a small axe—this is an ideal bone chopper and also extremely handy for fire-building."

Contrast this statement with one you will find in a pamphlet describing well-known mass-produced knives: ". . . still have the tough temper that cuts nails and holds its edge even when cutting bone." Does this indicate that the mass-produced knives are superior to, hence more expensive than those custom-made? Here's the shocker: the mass-produced knives are priced from under $30 whereas the custom-made knives sell in the $75 to $200 range. In a sense, sporting knives are like horses; some are made to withstand rough work whereas others, like expensive thoroughbreds, are designed to do a limited kind of

work, exceptionally well. You alone can decide which type of tool you need.

Another reputable knifemaker claims to have tried a dozen types of steel over some sixteen years of knifemaking with "fairly good" results. He favors a highly-modified silico-manganese-vanadium alloy of moderate carbon content which he feels is an outstanding steel that holds a cutting edge extremely well. But he is quick to add: "My honesty compels me to add that it also rust extremely well, too, if neglected after use." Despite this limitation, he sells all the knives he has time to make.

No outdoorsman should be without a good folding pocketknife, especially since they are very reasonably priced. More than 80 different styles of folding pocketknives are made by one company. These knives provide various combinations of some 16 different blade shapes plus other handy accessories. The same company also offers a line of hunting, fish filleting and general purpose sheath knives.

Experienced sportsmen generally disdain Boy Scout style multi-purpose knives because they are hard to keep clean and because some of the tools they contain are of doubtful value.

If you must have a multi-purpose knife, at least consider buying a Swiss army style knife rather than a conventional scout knife. The fisherman model has large and small pen blades, scissors, screwdriver, bottle and can openers, disgorger-scaler, Phillips screwdriver, reamer, tweezers and toothpick. The huntsman model is the same except that a saw, file and corkscrew replace the disgorger-scaler and Phillips screwdriver.

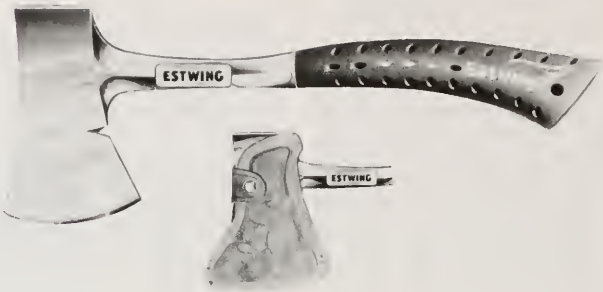
In sharpening a knife, remember first that the manufacturer made the knife with a proper bevel along the cutting edge. Start by laying the sharpening stone flat and drawing the blade of the knife toward you against the cutting edge. As the knife moves along the stone also move it laterally from side to side on the stone so the entire cutting edge is sharpened. Next, turn the blade over and repeat the process on the other side, moving the blade in the opposite direction. Remember also to maintain the same angle of blade against stone as you sharpen it near the point.

It is a serious mistake for an outdoorsman to put his knife away with blood, dirt or garbage on it. Even the salts from your hand may cause pitting of a fine steel blade. The only way to return it to usefulness if it gets pitted is to grind it down and retemper it. This may work if it is not pitted and scarred too deeply.

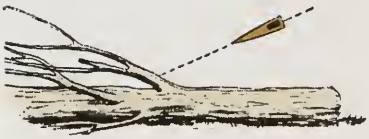
Before putting a knife back in the sheath, wipe the blade carefully with a dry cloth. Or, if necessary, moisten the rag, but be certain afterwards to dry the blade. Then run a lightly oiled rag over the blade.

The choice of an axe like the choice of a

One multi-purpose knife is the Swiss army style knife. The quality of steel and options offered with it make it far more versatile than the ordinary scout knife.



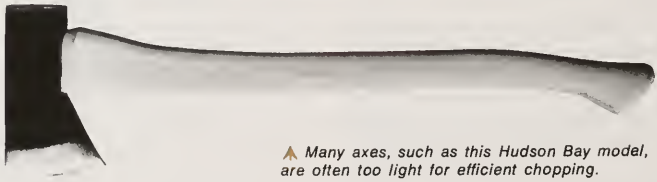
A fine, versatile implement, an axe in skilled hands is capable of performing many tasks, but it is probably the tool most misunderstood by the vacationing camper.



Limb a tree by striking the branches on the underside and cutting them flush with the trunk.

Three types of axe handles are shown here. Fawn foot, scroll, and the knob end.

The light weight of a hatchet makes it a good tool for back packing trips, but if weight is not a factor, it is probably best to carry an axe.

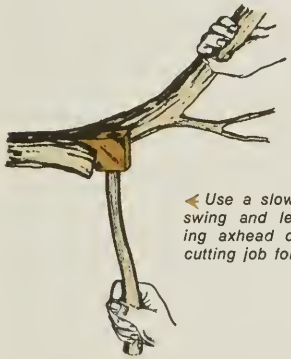


Many axes, such as this Hudson Bay model, are often too light for efficient chopping.

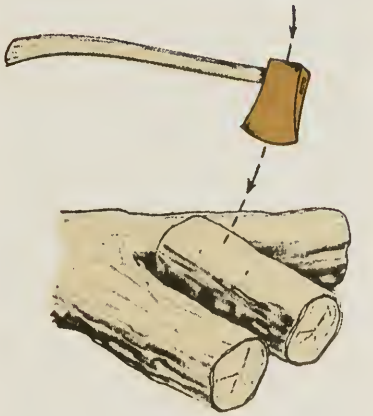
➤ *Inspect the end of the handle. One made with a vertical grain is less likely to split.*

▲ *Three-pound poleax is the best all-around camper's axe, with a 28- to 30-inch handle.*

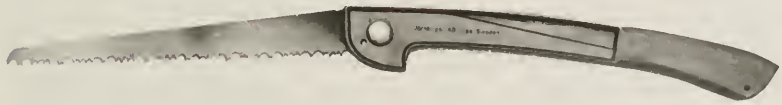
▲ *Cut a wide notch, then cut a second one above it in the opposite direction of the fall.*



◀ *Use a slow, rhythmic swing and let the falling axhead do the full cutting job for you.*



▲ *Safest way to split short lengths of logs is to position them in the crotch of a forked log.*



▲ *If you have room to take it along, this folding buck saw (when combined with a pocketknife), should handle all the cutting needs you will encounter.*

knife, must depend first on the jobs that will be asked of the tool. The axe is a fine and versatile implement, capable in skilled hands of performing a wide range of chopping, and shaping tasks. But the axe is perhaps the tool most misunderstood by the average vacation camper.

The average vacation camper and the wilderness traveler face different problems in the choice of an axe. Consider first the short-handled axe or hatchet. For the average camping family the axe small enough to be used with one hand may serve well. The chopping jobs will be few and infrequent because of modern camping stoves.

Firewood for the evening campfire is already stacked for the use of campers in many state and national parks and national forest campgrounds. The short-handled axe will have few jobs left for it, except perhaps driving tent stakes, a chore for which its flat end is suited.

But if this axe is used to do extensive chopping, it is another tale entirely. A seasoned outdoorsman would be quick to tell you why it is not good for such use. The short handle is a hazard. Miss a lick with the blade and the short arch of the handle may bring the cutting edge down against knee, shin bone, or foot. Chopping wood with one of these axes calls for even more care and caution than with a long-handled, full-sized axe.

What is more, you will wear yourself out fast chopping with a hatchet. If you are going far from the developed campgrounds, make room for a full-sized axe. It belongs on a canoe trip and surely on any trip where you will be taking a vehicle. The one place where you might not want a full-size axe would be a back-pack trip, where there is a necessity for cutting weight to a minimum. What would you carry in this case instead? The best all around combination might be a good sheath knife and a folding buck saw.

One final word for the hatchet buyer. Get good quality tempered steel in the head, something that holds a cutting edge, and a sturdy handle that is balanced in your hand; one with a sizeable and fairly heavy head fitted perfectly to the handle.

One of the biggest troubles with any axe is likely to be the loosening of the handle as the wood dries out. It needs to be expertly fitted to the head and wedged solidly.

The axe head may come in various styles, including such designs as the Kentucky, the Hudson Bay and the Michigan. The choice is largely a matter of personal preference, but a good choice would be either the Kentucky or Michigan style single-bit axes. These are good standard patterns.

The axe, like the camper's knife, deserves the best of care.

When you grind a new edge on an axe, use a slow speed grindstone and plenty of water or oil to keep heat down so you will not remove the temper from the blade. A better plan for sharpening is to use a file and hand-held stone. Start with the file and draw it outward across the edge of the blade then do the other side in the same manner. Put a fine edge on it with the stone. You will need a vise of some kind to hold the axe, or if you are sharpening a double-bitted axe, simply stick one blade in a stump and work on the other one.

A sheath is a good idea for both full sized axe or small-hand axe. An axe stuck in a tree trunk or stump by the blade is a camp hazard. This is doubly true with a double-bitted axe. It is better to keep it in the sheath and lying to one side out of the way. Then at night take it into the tent.

The axe, like the knife, is a highly important tool to the outdoorsman. Carelessness with either of them could bring genuine hardship, especially to those who camp or hunt in the wilderness and must depend on these basic tools to make camp living safer, easier and more comfortable.

See also: CAMPING; CAMPING EQUIPMENT; FISH PREPARATION; HIKING; SHARPENING.

Good Knots Mean More Fish

All too often a fisherman will lose a prize trout simply because he was not tying a proper knot. A little extra time and some know-how will keep that big one from getting away

When tackle-busting bass are subdued, you can attribute part of the success to the use of good knots that won't come apart during the underwater battle.

FOR FIVE HECTIC MINUTES, a Chicago fisherman had a battle-royal with a huge brook trout in the swirling rapids of the Kepimits River in Labrador. Suddenly the line went limp and the fish was gone!

A glum fisherman reeled in his empty line and as he did one could see the line hadn't broken. His knot had slipped. Just because he hadn't taken the time to knot the business end of his line to his lure properly, he had lost a prize brook trout.

The funny, and sad, part of this is that too many anglers tempt fate by not learning how to tie a knot that will not slip when the fish is exerting pressure on the line to escape.

Such simple knots as the improved clinch knot, for joining line to lure; blood knot, for joining two lines of almost the same dimensions; improved blood knot, for securing a heavy leader to a lighter line; improved end loop, for forming a loop; dropper loop, for tying additional lures to a leader; nail knot, to tie permanent leader butt to end of fly line; double surgeon knot, for joining two strands of monofilament line of two widely different diameters; turle knot, for dry or wet flies; or the tucked sheet bend to secure a line to leader are just a few of those which should be part of the fisherman's knowledge.

A poor knot becomes the weakest link between a battling fish and the angler.

Of 93 fishermen talked to during a week-long survey, 47 were using monofilament line, and of these, 40 were tying half-hitch, slip, jam or single overhand knots. None of these knots is recommended. Worst of all, such knots will reduce the breakload of the monofilament line far below its rated pound test.

The knots mentioned earlier are far superior to all others. All should have no less than five turns around the standing part of the line (except the blood knot). As the number of turns decreases below five, the strength of the line is reduced proportionately. In addition, each knot should be pulled up slowly and tightly so it cannot slip.

One of the favorite knots among fly fishermen is the turle knot. However, a testing firm has proved such a knot will average 35 percent less strength than an improved clinch knot on the standard pound tests used for tippets. This is why you should use the improved clinch knot when you tie flies and bugs to your line.

lacquer: see finishing, wood

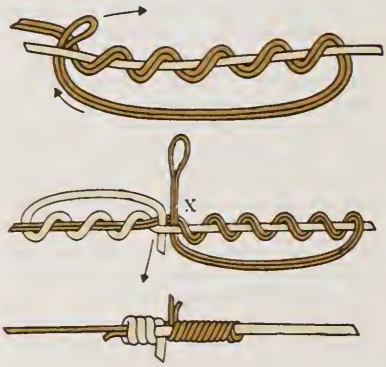
STRENGTH OF FISHING KNOTS

Type of Knot	Size Line	% of Unknotted Break Load
Overhand	6 lb. Mono	45-50
Improved Clinch	6 lb. Mono	95-100
Improved Blood	6 lb. Mono	85-95
Stu Apte Improved Blood	6 lb. Tied to 30 lb. Mono	95-100
Surgeon's	6 lb. Tied to 30 lb. Mono	95-100
Turle	6 lb. Mono Tied to #8 Hook	55-60
Perfection Loop	6 lb. Mono	60-65
Improved End Loop	6 lb. Mono	70-75
Blood Dropper Loop	6 lb. Mono	65-70

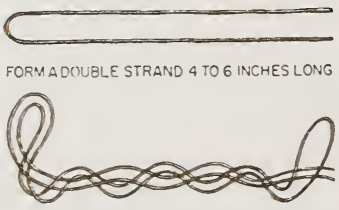
The near invisible, almost permanent continuation of your fly line can be obtained by using a 3-foot 30-pound-test monofilament. A nail knot is used to make the connection. (Keep in mind that you tie the monofilament line to the fly line, not the fly line to the monofilament.) Leader butts are tied to this with a blood knot. Knots increase the rigidity of a leader and aid you in making precision casts and the deft presentation of your fly.

Although a common carpenter's nail can be used to make the nail knot, some anglers use a piece of metal coat hanger, an ice pick, plastic swizzle stick, part of a curtain rod, or a hollow plastic tube. Whatever you use, the nail knot easily passes

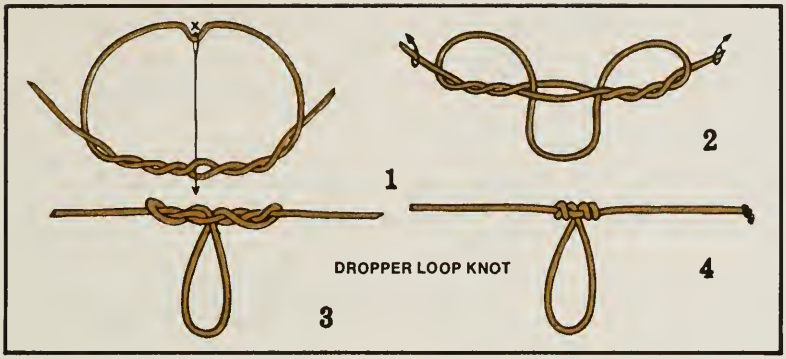
IMPROVED BLOOD KNOT



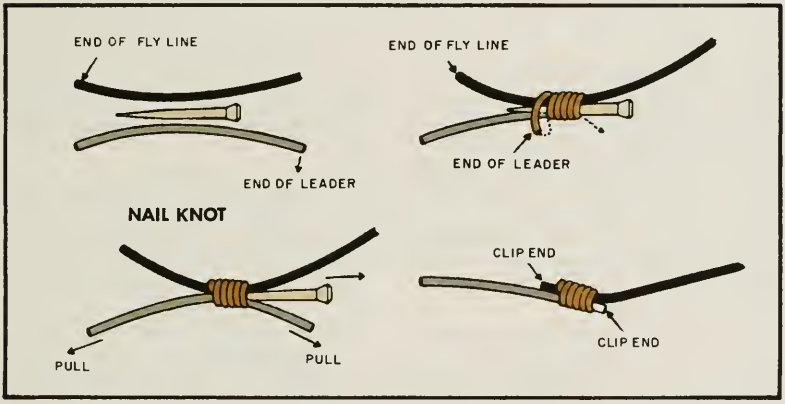
⚠ *Double the smaller line and wrap around the larger. Hold at X to keep from unwinding. Wind larger line around smaller line in opposite direction and insert end upward through loop at X. Pull up tightly and trim the ends.*


FORM A DOUBLE STRAND 4 TO 6 INCHES LONG
...FOLD THE "U" SHAPED-BEND BACK AND SPIRAL AROUND ITSELF FIVE TIMES FOR MAXIMUM STRENGTH

IMPROVED END LOOP



Make a loop in line and wrap one end overhand several times around other part of line. Pinch small loop at X and thrust between turns (1). Place pencil or finger through loop to keep it from pulling out and pull on both ends of line (2). The knot will draw up as in (3). Finished dropper loop knot (4).

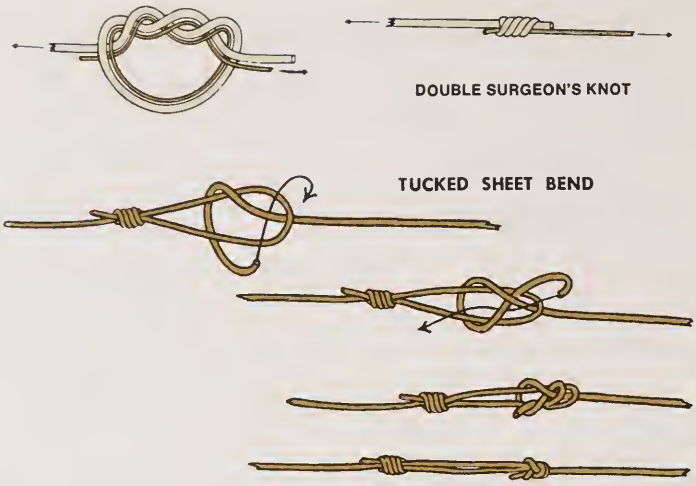


Hold line, leader and tapered nail or small piece of tubing alongside one another, allowing ample overlap. Wind leader downward around nail, line and itself, then run end of leader back along nail or through tubing. Pull tight, slip knot down nail, remove nail. Pull tight.

through the guides and you can leave the butt section joined to the line when you want to change the leader's taper.

The nail knot is an improvement over the knotted loop. It can stand hard shocks, and the harder you pull on the knot, the better it "bites" and grips. Best of all, it is not bulky as the old knotted loop.

To tie such a knot, hold the line, leader and tapered nail or tubing alongside each



In this knot, used for tying line to leader, the end is brought back and tucked through the loop. Be careful that the loop nearest the end of the large loop does not slip through loop before it is jammed making a figure eight.

other. Allow ample overlap. Then wind leader downward around nail, line and itself six times and run end of leader back along nail or through tubing under loops. Pull both ends of leader tight. Slip knot down nail, tightening by pulling both ends of the leader as it goes up. Slip nail or tubing out and retighten knot by again pulling leader ends. Finally, pull line and leader tight, clip end of line and leader close to knot.

Pike and many saltwater fish have sharp teeth or gill plates that will fray a leader. Leaders for such fish should have shock tippets—strands of heavy monafilament which are difficult to cut or fray. A double surgeon's knot is best for tying heavy shock tippets to the fine leader point.

Using a surgeon's knot makes it easy to connect a 2-pound test monofilament line to 50-pound test line. Lay the two strands parallel with plenty of overlap; treat the two lines as a single strand and tie a simple overhand knot in the two lines (see sketch). Repeat overhand knot, pulling the two strands all the way through the loop. Pull tight and clip ends.

In bait-casting, spinning and trolling, a 4 to 6-foot length of monofilament line of the correct test strength is often desirable. A blood knot serves well here.

The improved blood knot is ideal for securing a heavy monofilament shock leader to a lighter line or tippet. Properly tied, you can fasten a 50-pound test monofilament shock leader to a 10-pound test tippet for fly rod fishing for tarpon or big striped bass. Tests reveal the smaller line would break at its breakload—not at the knot.

To tie the blood knot, double enough of the smaller line so you can wrap it around the standing part of the larger line at least five turns or more. Place the doubled end down between the strands. Hold looped line between thumb and forefinger to keep from

unraveling. Next, wind the large line around the standing part of the doubled line three times in the opposite direction. Insert this end through loop. Pull knot together slowly and tightly to keep it from slipping. Trim ends.

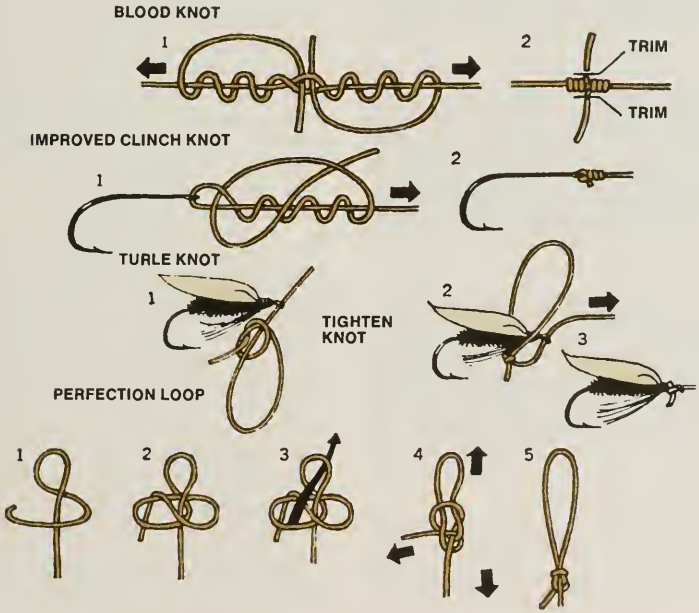
The improved clinch knot can be used for tying flies, bait hooks, lures or swivels to a line or leader. It is more secure than the common clinch knot. When fishing with fragile tippets, 4X and below, pass the line through the hook eye twice before forming the knot, particularly if you fish tiny nymphs or midges over trout.

It is a rare sight today to spot an angler fishing with more than one fly at a time. However, if you should want to use combinations such as two or three wet flies on a single leader, a wet fly and a nymph or a dry fly and a wet fly, it is necessary to allow for connecting strands of extra monofilament to be attached to the basic leader. These strands will be at right angles to the leader. They should be tied to loops put into each additional leader at separate points with the dropper loop knots.

It is not necessary to go into details on how you can tie the turle, tucked sheet bend and improved end loop knots. The illustrations do a far better job of showing you how to tie these.

A few hours spent in a practice knot-tying session can end those moments of frustration when your line comes apart during a wild fish battle because of an improperly tied knot. Good knots—next to your rod and reel—can be the fisherman's best friend and lead to far more fish in the creel and far fewer disappointments.

See also: BASS FISHING; FISHING; LURES.



Tying Useful Knots

Knot tying is one of the most valuable crafts known to man and it is likely you will find many opportunities to try these out

COULD YOU DESCRIBE the fishermen's bend? The cat's paw? Or the Englishman's tie? Do you even know what they are? Probably not. In fact, there are probably hundreds of knots, each designed for a specific purpose, that the average person could not begin to attempt to tie. Yet knots are one of the most useful crafts known to mankind. It is almost impossible to think of any situation in life that does not use some of them, some of the time.

Yet it is not necessary to know hundreds of knots, or for that matter, even any of those mentioned above. But any camper, homeowner, boater, fisherman or hunter should know enough basic knots for his purposes, lest he become the poor fellow who fashions his own, twisting and turning a rope into some conglomerate mess. And equally as important he should know how and why and when a certain knot is used.

It should be clarified that knots, in general, refer to all manner of tying, which includes not only knots, but hitches, whippings, lashings and splices.

Whippings, lashings and splices are, for the most part, considered permanent. They are either looked upon as a one-time chore as in the case of whipping the ends of a rope, or as a semi-durable fastening as with lashing. They often do not adhere to the basics of good knot tying. Though extremely useful in primitive situations, the chances of your using any of them are slight. And because in some cases there are simpler, though more temporary means of accomplishing the same thing, we will not be concerned with their intricacies.

In the average man's vocabulary, knots and knot needs usually encompass just knots and hitches. A knot is a pattern formed in a rope that holds by its own friction. A hitch must depend partly on the friction of the rope against an object other than itself.

Knots and hitches are usually considered to be temporary; a way of tying something up for awhile until no longer needed, making it imperative that they tie easily, hold fast, not jam, and untie easily—the four basics of a good knot.

You start with the rope. The success of the job will depend a great deal on the strength of the rope itself, and the condition it is in. You can use cotton, hemp, polypropylene, or nylon, which increase in cost and strength in that order. But it is foolhardy, and often dangerous, to expect a rope and its knots to give better service than their weakest point. Though it is interesting to note that both knots and hitches, while considerably stronger than just the rope itself, weaken the the rope fibers. If anything gives on a weakened rope, it will not be the knot itself but the area it is straining against.

Financially and service-wise it is imperative that all roping be protected from pre-

mature aging and damage. Keep it dry, or if it becomes wet, dry it out as soon as possible to prevent rotting. Do not step on it or drag it through the dirt, for small particles of soil within the rope will slowly cut the fibers. Never leave a rope knotted or tightly stretched any longer than is necessary. This weakens it. Do not tighten, taut or hang it across sharp corners or edges.

While it is common practice to singe off loose, stubbly hemp fibers for ease in handling, keep a synthetic rope away from flames, for it will melt. Which, incidentally, makes an excellent way of sealing the ends of a man-made rope. Just hold the end in a match flame until the fibers fuse. But do not touch until cool! Keep all rope ends from raveling either by this fusing, or knotting, or binding with tape. When not in use, the rope should be coiled and put up.

Now decide what it is that you want to do. Keep a rope from slipping through a hole? Tie a couple of ropes together? Tie up something? Or tie to something? Make a loop?

Taking them purpose by purpose, start with the simple end knot, or stopper knot, which accomplishes just that. Used most frequently at the end of a rope, it stops the rope from either unraveling during use or prevents it from slipping through a hole, such as a tent grommet.

The overhand knot is the more compact of the two we will look at in this category. It is probably the simplest and commonest of all knots. It takes little time to tie and is usually easy to adjust. It can, however, work itself loose, or at times even jam. For many purposes though, it is very satisfactory.

The figure-eight knot, the overhand knot's cousin, is a bit more difficult to tie and a bit more bulky, but will not jam and is easier to untie. Use it when the overhand knot fails to hold.

For a joining knot, a knot is used that should be familiar to anyone who has ever tied a bundle or mended a shoestring—the square knot. This knot makes an impartible bond between two ends of rope and if you have ever had reason to question its se-

Overhand Knot

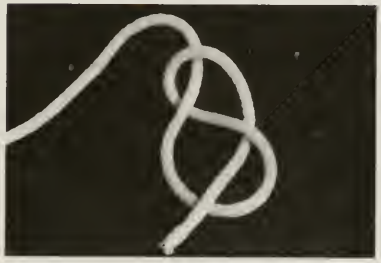


Figure-Eight Knot

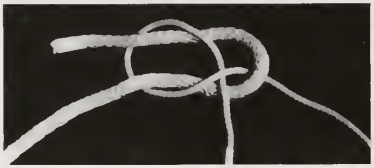
Square Knot

"Granny" Knot

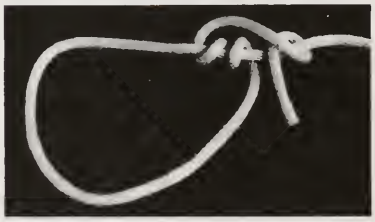
curity, question your method. You might have made a granny knot by mistake—a square knot gone wrong.

Or maybe your trouble was that you were trying to tie two ropes of different sizes together, perhaps to make a longer rope because the one wouldn't reach. A square knot will not hold. A sheet bend will. A sheet bend is just a square knot with an extra twist in it to hold. The name originated in the sailing vessel days when "sheets" referred to a number of the ropes used to rig the ship and its sails. "Bending" is just a nautical term for making a loop.

Instead of tying rope to rope you may want to tie a rope, or make it fast, to something else. Then you resort to a hitch, or a securing knot. The clove hitch is the strongest hitch there is and is easily adjusted. It will hold forever in place—but only as long as it is kept taut. For a rigged-up clothesline it is tops. For horses, dogs, boats or the like it is useless.



Sheet Bend



Tautline Hitch

When the ends of a line are frayed like this, simply tie an end knot and the line will fray no further than where you place the knot.

Instead, two half-hitches (the easiest of all hitches), will do the trick of tying up to something when you need to be sure it will hold fast.

There will be times when you do not want to actually tie onto something, but rather wish a loop knot, either to toss over or fashion around a pole or post. A bowline (pronounced bo'lin), is a permanent or fixed-type loop. This loop will not pull tight, but will stay the size you make it. Its use originated from the attaching of the bow line to a boat.

There are times, such as in the case of a tent guy rope, when an adjustable loop would be the better solution. A tautline hitch, which is not actually a true hitch, performs this or similar jobs admirably. This knot can easily be slid back or forth to slacken or tighten, yet the loop will not budge under strain.

These are just eight knots picked from literally hundreds. All are simple. Some you may already know. Each is designed to do a specific job. Each is associated with a special duty. And unless you wish to specialize in fishing knots or fly-tying, mountain climbing, or rope crafts, they are all you will ever need to know.

So cut off about a six-foot hank of clothesline and practice. This rope will give you a better "feel" of a knot before you turn to the harder-to-manipulate synthetic ropes. Practice until you know them. Still it befits a good sportsman to know a knot. Know it well. Know why it is used. And mostly know when to use it.

See also: BASS FISHING; CAMPING; CAMPING EQUIPMENT; CRAFTSMANSHIP; HIKING; SPLICING; TENT.

Ladders In and Around Your Home

Deciding what type you need, what to watch for when buying, and safety tips on the use of ladders

ONCE, LADDERS WERE nothing more than crude notches carved into an upright log, but today there are so many different sizes, styles and materials used in household ladders that it is difficult to determine which are the best for one's needs.

If you live in a house, you may need two ladders—a stepladder for indoor work and a straight ladder, or extension ladder, for use outdoors. The outdoor ladder should be long enough to extend a minimum of three feet higher than the highest point you want to reach.

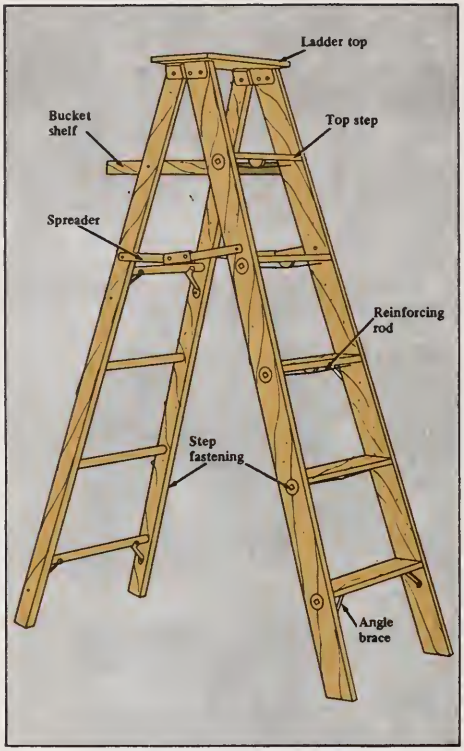
If you live in an apartment, however, a stepladder probably will meet all your needs and will be easy to handle. Its size will depend on the highest point you want to reach, bearing in mind that you should not stand higher than the step below the ladder top. Never stand on the top of a stepladder.

So, as for the size, only your needs can determine what is the best for you. But there are some general clues which can help you avoid a serious accident or wasted money. First, price should be secondary to your needs—you will not be saving money buying a bargain ladder that ends up sitting dormant in a closet somewhere.

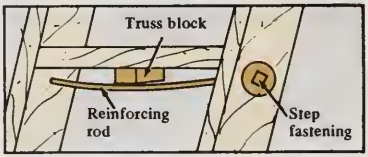
Make sure you check the ladder for weak steps, loose rungs, or other defects before you buy it. Also, do not buy an unidentified ladder. Be sure that the name of the manufacturer or distributor is on the label. This information may be important in case of a quality or accident problem. Look for a seal (probably a decal) affixed to the ladder, indicating that the ladder conforms to the standards of the American National Standards Institute (ANSI) or the Underwriters' Laboratories, Inc. (UL). The absence of a seal, however, does not necessarily imply that the ladder is of poor quality.

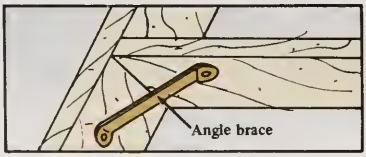
In the ladders which are now available to you, there are three major materials used with differing advantages; wood, aluminum and fiberglass. Wooden ladders are sturdy and bend little under their specified loads. They are heavier to carry than metal ladders, and large sizes are even harder to

laminates, plastic: see kitchen
lamppost: see ornaments, lawn
lamp rewiring: see wiring, electrical



Besides the steps, note the important points to look for in a typical wooden stepladder.





handle. When dry, wooden ladders are safe to use around electrical circuits or when you are working with power tools. If wooden ladders are used indoors, or adequately protected from moisture and sunlight, they will last many years. Unprotected in the open, however, they may be attacked by wood-destroying insects, weakened by rot or cracked and split by the action of sun and rain. Once weakened, wood may break easily and suddenly, causing a serious safety hazard.

Metal ladders are generally a little more expensive than wooden ladders of the same quality, but they last longer because they are not subject to the deterioration of wood. Aluminum and magnesium ladders are comparatively light, weighing only about two-thirds as much as those made of wood. They weigh about the same, but magnesium ladders are somewhat more costly. Magnesium corrodes (turns black) more than aluminum and has less impact resistance. Aluminum and magnesium ladders are not recommended for use around electrical circuits.

Fiberglass is the newest material to appear on the ladder market. It is used to make the side rails of high-grade metal stepladders and straight extension ladders. The result is a nonconductive ladder that is light, corrosion resistant, serviceable and practically maintenance free. These ladders do not dry rot or absorb moisture, and the fiberglass side rails have greater impact resistance than wood, aluminum or magnesium. Ladders of this type, however, are still so expensive that their use is generally restricted to the industry.

Of the many styles of ladders used, the stepladder and extension (straight) ladder are the most practical and widely used. The stepladder is a self-supporting portable ladder. It is nonadjustable in length with flat steps and hinged back. Size is determined by the length of the ladder measured along the front edge of the side rails. Stepladders

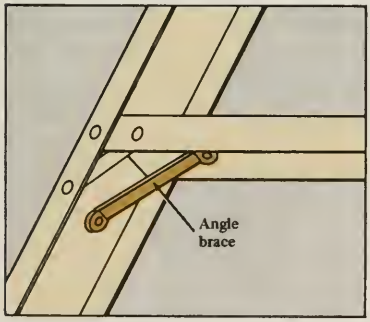
are usetul tor many indoor and outdoor jobs where the height to be reached is low and the ladder can be rested on a firm surface.

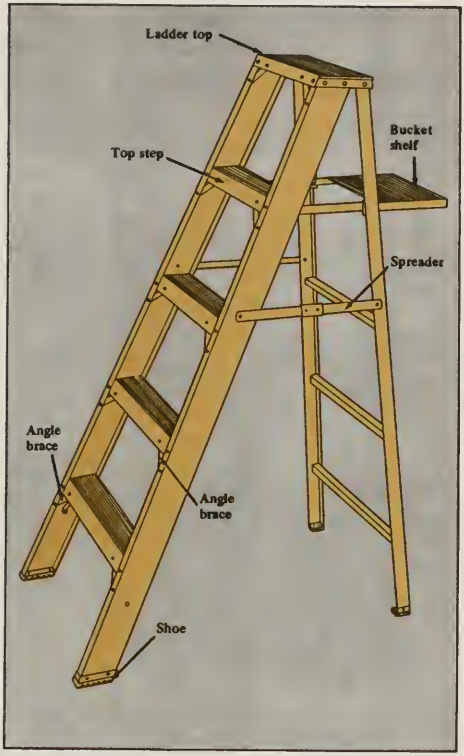
Both wood and metal stepladders are available in three categories. They are: Type I, heavy-duty (250 pounds load-carrying capacity); Type II, medium-duty (225 pounds); and Type III, light-duty (200 pounds). These categories are accepted and widely used by the ladder industry. Look for the duty rating when you purchase a ladder.

In purchasing either a wooden or metal stepladder there are many features to look for (shown in diagram), but the most important are the steps. On a wooden stepladder they should be flat, parallel and level when the ladder is open, with no more than 12 inches of space between each step. They should be at least ¾-inch thick and at least 3½ inches deep. Each step should be braced either with a metal reinforcing rod or a metal angle brace. If reinforcing rods are used, then the bottom step should always be braced with metal angle braces.

Ends of the reinforcing rod should pass through metal washers of sufficient thickness to prevent pressing into and damaging the side rails.

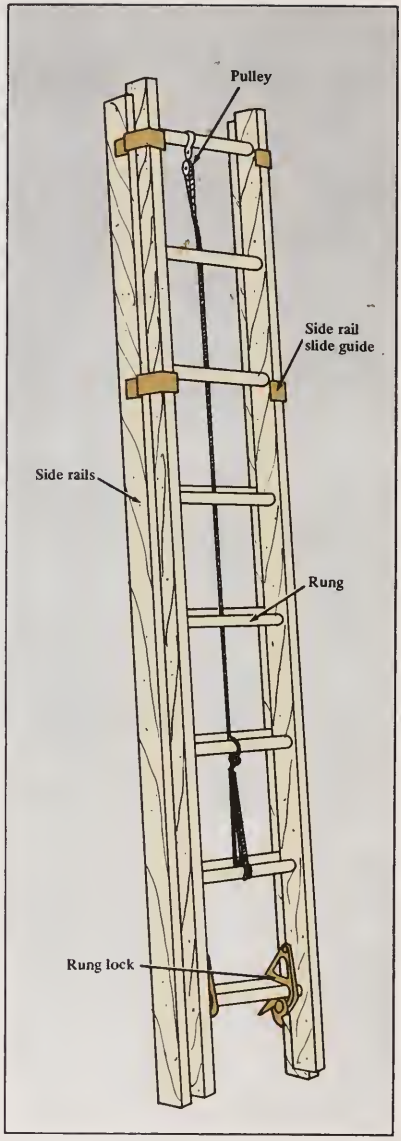
A wood or metal truss block should be fitted to the bottom of each step (when metal reinforcing rods are used), and positioned at the center between the rod and the step. The bottom step should be reinforced with metal angle braces securely attached to the step and each side rail. Steps should not protrude more than ¾-inch beyond the front of the side rail, nor should they have splits, cracks, chips or knots.





Key features to look for in a metal stepladder. Ladders are available in aluminum and magnesium and offer varying advantages.

On a metal stepladder, steps should also be flat, parallel, and level when it is open. Also, steps should be corrugated, have raised patterns, be dimpled, be coated with



Major points of a wooden extension ladder.

skid-resistant materials, or otherwise be treated to minimize the possibility of slipping. Again, there should be no more than 12 inches between steps.

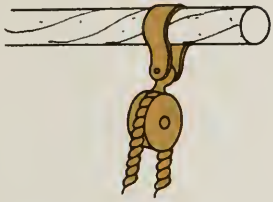
The depth of the step or tread should be no less than three inches for 225 or 250-pound capacity ladders; 2½ inches for 200 pound ladders. They should have no sharp edges, nor should they be bent or dented in any way.

The other major ladder, the extension ladder, is simply a straight ladder which is adjustable in height. It consists of two or more straight sections traveling in guides or brackets so arranged as to permit length adjustment. Its size is designated by the sum of the lengths of the sections, measured along the side rails.

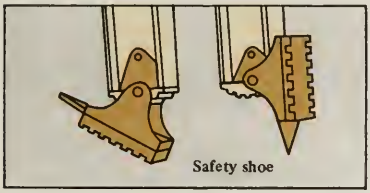
Each section of an extension ladder should overlap the adjacent section by a minimum number of feet, depending on overall length. If an extension ladder is up to 36 feet long, the overlap should be three feet; if total length is between 36 and 48 feet, overlap should be four feet; and if the two sections add up in total length to between 48 and 60 feet, overlap should be five feet. Also, a ladder should be equipped with positive stops to ensure that it cannot be opened too far.

To eliminate confusion in identifying the length of an extension ladder because of overlap, the Federal Trade Commission requires that the total length and working length be clearly marked: for example, "Maximum working length 17 feet; total length of sections 20 feet."

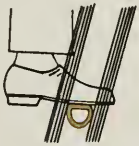
Important things to look for in a wooden extension ladder are: the feet, they should be equipped with safety boots or shoes (these can be ordered as an accessory); rope and pulley (pulley of not less than 1¼-inch outside diameter and rope not



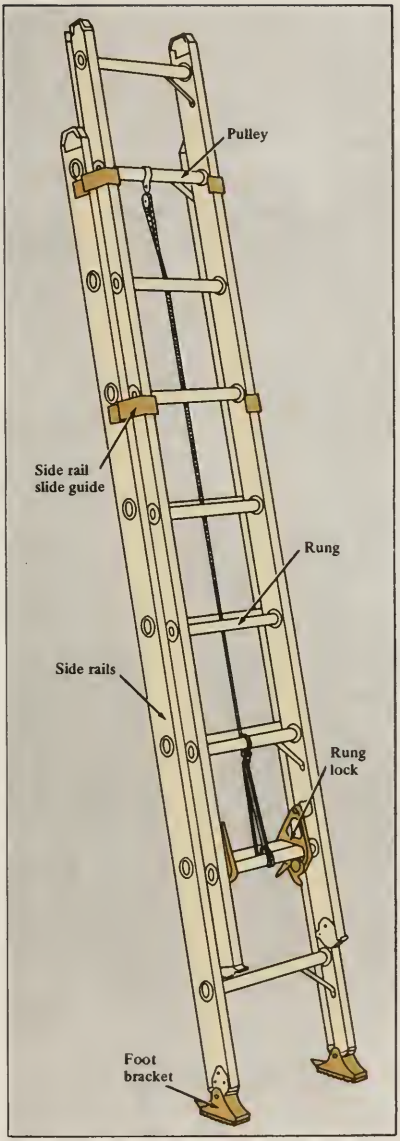
▲ *The pulley on an extension ladder should be not less than 1¼ inches in outside diameter.*



▲ *Close-up drawing of safety shoes on aluminum extension ladder shows it must have corrugated bottoms to prevent slipping.*



▲ *The rungs on aluminum ladders should be round with a flat step surface and slip-resistant tread. Top and bottom rungs should be not more than 12 inches from the ends of the side rails to provide for extra strength and stability.*



➤ *A metal extension ladder should have a pair of feet at the base to insure a strong, secure stance for its lightness.*

less than 5/16-inch diameter with minimum breaking strength of 560 pounds); and rungs (these should be round and of hard wood, free from crossgrain, splits, cracks, chips or knots, and less than 1⅛-inches in diameter not more than 12 inches apart).

The same points are important on a metal ladder, but the rungs should be coated with a slip-resistant compound.

In actual use, there are a number of important points in ladder safety which must be fully understood before doing any work. First, inspect the ladder prior to each use. Oil moving parts and tighten loose fasteners. Check the rope and pulley on an extension ladder for wear and breaking strength.

Extension ladders should be set up in a specific manner in order to avoid muscle strain or loss of control. Brace the lower end of the ladder against something solid so that it cannot slide. Then grasp uppermost rung, using both hands. Raise the top end and walk forward under the ladder, moving your hands to grasp other rungs as you proceed. When the ladder is erect, move it to the desired location and then lean it forward to the top resting point.

Always place ladders at the correct angle with the wall. The base of the ladder should be one-quarter of its working length away from the wall or support.

If the ladder is placed at too great an angle—that is, with the base too far out—it is subject to strain that can cause it to break or slip. On the other hand, if the ladder base is too close to the wall, the ladder is likely to tip backwards.

Place your ladder so that it has a firm footing. The feet of either a stepladder or an extension ladder should be level. If the ground is uneven or soft under one foot, brace as shown. If necessary, the ladder should be lashed or held in place to prevent slipping.

Be sure that a stepladder is fully opened and has its spreaders locked before you climb it.

Adjust the length of an extension ladder only when your eye level is below the level of the locking device so that you can see when the lock is engaged.

Be sure, when using an extension or straight ladder, that it is the proper length to reach the desired height. For example, in using an extension ladder to reach a house roof, be sure the top of the ladder extends at least three feet above the roof edge. Do not climb up an extension ladder so far that you have to reach down to grasp the side rails.

Never climb higher than the step below the top of a stepladder. If you stand on the top, you are in danger of losing your balance.

Go up and down carefully, always facing the ladder. Carry your tools or other work materials in your clothing or attached to a belt. Take only one step at a time.

Move the ladder to where the work can be done without reaching far to one side from the ladder. Overreaching can cause you to fall.

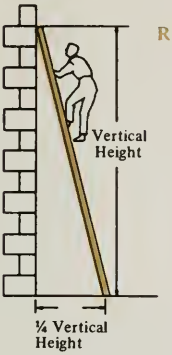
Be extremely careful when using metal or wooden ladders around electric circuits, power tools or appliances. Metal and wet wood conduct electricity very well.

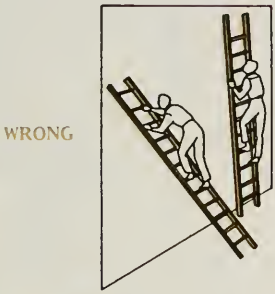
Maintenance of a wooden ladder consists of storing it in a dry indoor spot. If it must be stored outdoors, protect it with a coat or two of a clear sealer, spar varnish, shellac or a clear wood preservative—it should not be painted because this would prevent periodic visual inspection of its condition. Linseed oil will help to rustproof metal parts. Replace worn or frayed ropes on extension ladders and always check any ladder that has been dropped or fallen before you use it again.

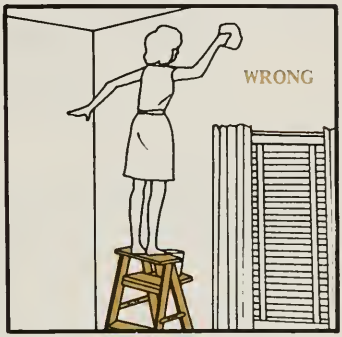
Cracked or rotten rungs of wooden ladders should be repaired by a manufacturer or competent repair shop. Do not do it yourself unless you have experience and the tools to do quality work. M.E.F.

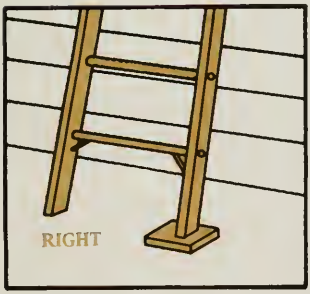
See also: PAINTING, HOUSE.

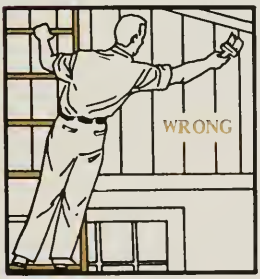
Ladders In and Around Your Home 1525











⚠ *Important safety reminders for use of ladders.*

A Sailboat for Land Lovers

This land-sailing craft can be easily built in two weekends

WHETHER YOU HAPPEN to be an experienced sailor or strictly a landlubber, this easy-to-build land-sailing craft will provide you with unmatched sporting fun.

Land-sailer takes only two weekends to build and is made to come apart for easy hauling in a station wagon or on car-top racks.

You can rig Land-sailer with just about any small sail if you already have one, or you can make the sail and spars yourself using the plans shown.

On a hard, flat surface such as a beach or parking lot, this one-man craft quickly picks up speed and handles with precision.

Most of the materials needed for Land-sailer can be found at a building supply store and a bike shop.

Start by constructing the rear section according to the dimensions in the diagram. Use exterior ½-inch plywood for the decks and cedar 2 x 4s for the braces, struts and rear crossmember. All contacting surfaces should be coated with wood-glue and fastened with 1½-inch flat head screws. Before you secure the upper deck, be sure to drill the ½-inch hole for the rear main bolt. It should be positioned where it can easily be reached through the upper deck cutouts. Also, paint the underside of the deck and the areas that it will cover, since these places will be impossible to reach once the deck is secured.

For the axles, be sure to use case-hardened machine bolts. Have them welded to 12-inch pieces of ¾-inch round steel and drilled as shown.

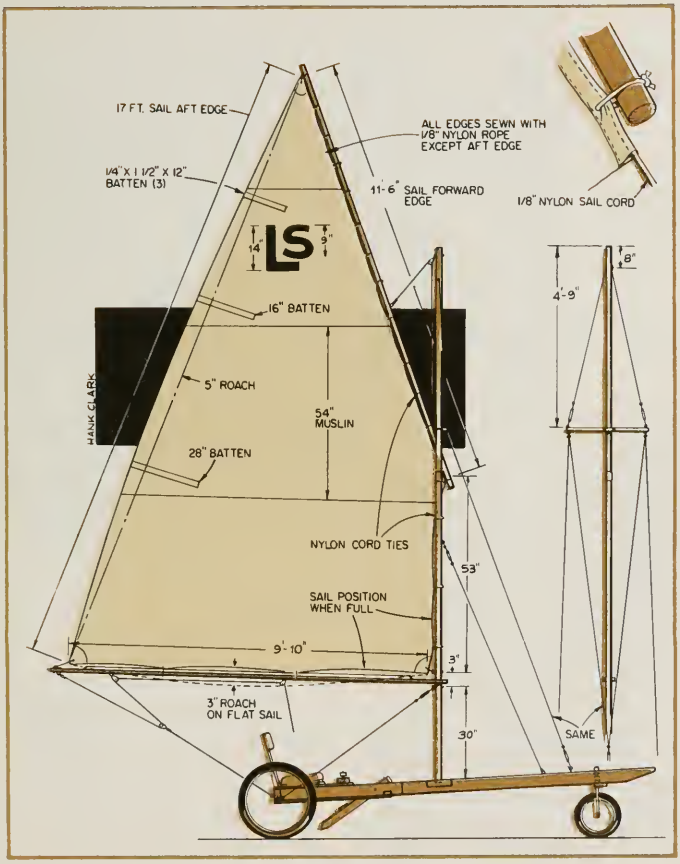
Use 24-inch, front bicycle wheels with ⅜-inch axle holes on the rear of Land-sailer, and since bearings are not used, pack the hubs with heavy wheel bearing grease. If you have trouble finding wheels with ⅜-inch openings, get a pair that can be drilled out to that size.

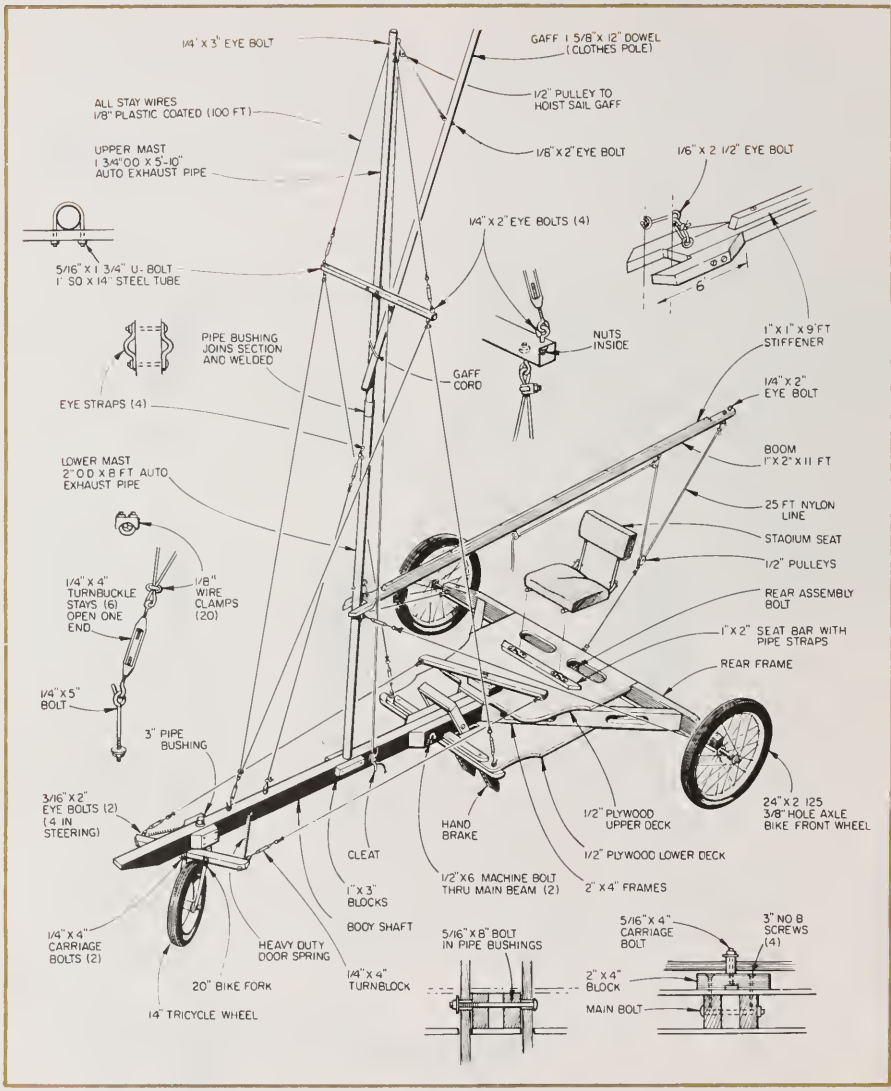
With the rear section completed, select a top quality, 10-foot pine 2 x 4 for the length shaft. Sand one end until it easily slides in and out of the rear section. While it is in the rear section, mark it for the rear main bolt. Remove the shaft and drill a ½-inch hole in the marked spot.

The front end of Land-sailer uses a 14-inch wheel mounted on the steering fork from a 20-inch bike. The arms of the fork are bent backward, using a vice or hammer, until the ends are parallel to the upper shank of the fork.

A 3-inch piece of pipe, electrical conduit or similar tubing, inserted into the length shaft serves as a bushing for the steering

Side detail of land-sailer craft.




1/4" X 3" EYE BOLT
GAFF 1 5/8" X 12" DOWEL (CLOTHES POLE)
ALL STAY WIRES 1/8" PLASTIC COATED (100 FT)
1/2" PULLEY TO HOIST SAIL GAFF
UPPER MAST 1 3/4" OD X 5'-10" AUTO EXHAUST PIPE
1/8" X 2" EYE BOLT
1/6" X 2 1/2" EYE BOLT
1/4" X 2" EYE BOLTS (4)
5/16" X 1 3/4" U-BOLT 1" SQ X 14" STEEL TUBE
NUTS INSIDE
1" X 1" X 9 FT STIFFENER
PIPE BUSHING JOINS SECTION AND WELDED
GAFF CORD
1/4" X 2" EYE BOLT
EYE STRAPS (4)
BOOM 1" X 2" X 11 FT
LOWER MAST 2" OD X 8 FT AUTO EXHAUST PIPE
25 FT NYLON LINE
STADIUM SEAT
1/2" PULLEYS
1/4" X 4" TURNBUCKLE STAYS (6) OPEN ONE END
1/8" WIRE CLAMPS (20)
REAR ASSEMBLY BOLT
1" X 2" SEAT BAR WITH PIPE STRAPS
REAR FRAME
1/4" X 5" BOLT
3" PIPE BUSHING
3/16" X 2" EYE BOLTS (2) (4 IN STEERING)
HAND BRAKE
1/2" PLYWOOD UPPER DECK
24" X 2 125 3/8" HOLE AXLE BIKE FRONT WHEEL
1/2" PLYWOOD LOWER DECK
CLEAT
1/2" X 6 MACHINE BOLT THRU MAIN BEAM (2)
2" X 4" FRAMES
1" X 3" BLOCKS
BOOY SHAFT
1/4" X 4" CARRIAGE BOLTS (2)
HEAVY DUTY DOOR SPRING
5/16" X 8" BOLT IN PIPE BUSHINGS
5/16" X 4" CARRIAGE BOLT
3" NO 8 SCREWS (4)
1/4" X 4" TURNBLOCK
2" X 4" BLOCK
20" BIKE FORK
MAIN BOLT
14" TRICYCLE WHEEL

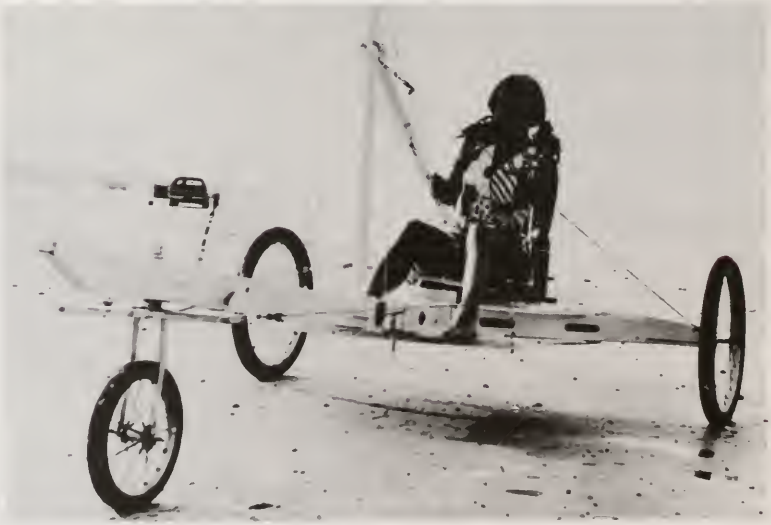
▲ *Full parts diagram for the land craft's chassis.*

A Sailboat for Land Lovers 1529

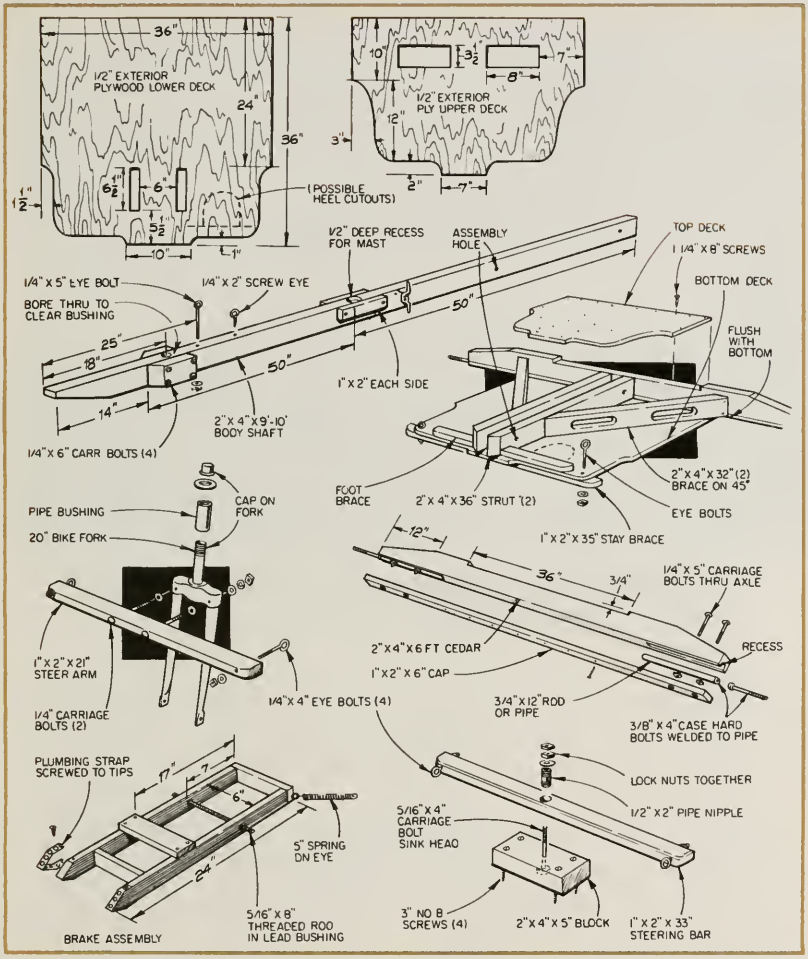
▲ *Hoisting the sail and preparing for a trip down the beach; the sail can be an extra one you have lying around (50 to 90 square feet) or close-woven muslin.*

➤ *Land sailer takes only two weekends to build and is made to come apart for easy hauling on a car-top rack (as pictured here), or in the back of a station wagon.*

You can make an inexpensive durable mast out of auto exhaust pipe. A pipe bushing connects the ends and the joint is welded.



An optional brake can be installed on Land-sailer.



Steering, brake and daggerboard assembly.

fork. The pipe should fit the fork closely but allow it to turn freely. The rest of the steering is made according to the diagrams.

The optional brake can be installed on Land-sailer, but the only fully effective braking for this type of craft is accomplished by heading directly into the wind.

If you plan to install the brake, note that

the handle should not be fastened until the rest of the assembly is passed through the deck cutouts. When the craft is disassembled, the brake cross-pin must be removed along with the two main bolts.

Now give your Land-sailer several coats of exterior enamel. White looks good with silver brake and steering parts.

If you have a boat sail within the 50 to 90 square foot range, you will probably be able to fit it to your Land-sailer by altering the stay wires. If you are making the sails and spars yourself, follow the dimensions shown using closely woven muslin for the sail. Be sure to shrink the cloth before cutting it.

You can make a very inexpensive yet sturdy mast out of automobile exhaust pipe. The straight, 8-foot lengths are available at most auto part stores. The bottom 8-feet of the mast is 2-inch O.D. pipe and the upper 5-foot, 10-inch piece is 1¾-inch O.D. pipe. Get a pipe bushing to connect the ends and have the joint welded.

The gaff is made of a single 1⅝-inch dowel and the boom is a 1 x 2 with a ¾ x ¾-inch wood strip glued and nailed to it.

For the seat, a stadium chair is used, mounted on a bracket made of plumbing strap. These seats vary in style so you may have to alter the bracket to fit the type of seat you select.

Since sailing on land involves many of the same techniques used on the water, you can refer to a boating guide or encyclopedia for the basic maneuvers.

With a little practice at the helm of your Land-sailer, you are ready for many miles of sailing fun.

See also: BOAT BUILDING; BOATING; SAILING; TRAINING BOAT.

MATERIALS LIST

Quantity	Size and Description	Purpose
3	2″ 4″x6′ cedar	struts, braces and crossmember
1	2″ 4″x12′ pine	body shaft, fork blocks and steering base
2	1″ 2″x10′ spruce or pine	steering arms, seat bracket and brake
1	1″ 2″x6′ spruce or pine	lower crossmember
1	1″ 3″x1′ spruce or pine	mast base blocks
1	½″ 2′x3′ AC grade exterior plywood	upper deck
1	½″ 3′x3′ AC grade exterior plywood	lower deck
1	1⅝″x12′ fir dowel	gaff
1	1″ 2″x11′ pine	boom
1	1″ 1″x9′ pine	boom
2	24″x2.125 front bicycle wheels, ⅜″ holes	rear wheels
1	14″ tricycle wheel with axle	front wheel
1	20″ bicycle steering fork and screw cap	steering assembly
1	3″ piece of metal pipe to fit fork shank	bushing for steering fork

NOTE: Also need pipes, tubing, fittings, hardware, muslin, rope, exterior enamel, wood glue, stadium seat, etc.

Consider the appearance of your property from the street, especially the house in relation to the entrance, drive and walks. This photo may contribute ideas concerning this aspect.

Enhancing the Beauty of Your Home with Landscaping

Although it is largely a matter of personal taste, there are some basic factors in landscaping that must be considered

WHETHER YOU BEGIN with a new home and an undeveloped yard or a remodeled house and an older garden, planning is required to develop the landscaping you want. Start with an inventory of your site. List the assets and drawbacks. Consider the sun, its path, and its intensity during all seasons. Such factors affect the size and number of areas you can develop.

Basic considerations. When the number of sunny days is limited, create a few large areas to trap the sun. Look to the south and southwest for warmth and let walls reflect sunlight to plants that need extra warmth. But when the sun is plentiful, create a series of areas to trap the shade. Look to the north and northeast for relief. Use plants that promote a feeling of coolness, lush ground covers and perhaps even moss.

language of electronics: see electronics
lantern: see camping equipment
larkspur: see garden planning

Smooth, level lawn serves as an outdoor game room for croquet, golf putting, lawn bowling. Especially noteworthy is the spectator patio-gallery.

Sun-oriented areas face south or west and are recommended for regions where the sun's rays are welcome year around. A southern exposure invites a full day's sun, dries quickly after rains and warms quickly on winter days. A western-facing area offers greater contrast, cool mornings and warm afternoons. Neither location is suggested for the hotter sections of the country. There, sun-oriented patios generally require extensive shade, cooling and screening to withhold the slanting rays of the late afternoon sun.

Shade-oriented patios face north or east and are best in the warmer states. They are cool and restful. A northern exposure is coolest and sections of a patio facing that direction may never see the sun. An eastern orientation welcomes the cooler morning sun and protects against the hot evening rays. Take into account the appearance of the property from the street, particularly the house and its relation to the entrance, drive and walks. Consider sites for a private terrace, service facilities and a sunny section for gardening. The aim must be for livable grounds closely related with the house and more than just a setting for flow-

Consider blending pools with your garden. Swimming pool combines with landscaping and rock wall in an effective transition.

ers and shrubs. The latter are the final, personal finishing touches to be held within the over-all framework.

Approach the house as a unit. While you may only intend to install portions of the landscaping at the beginning, design the job as a whole. Your landscaping will have a continuity and will "hang together" when the entire job is completed. Remember the primary objective is to complement and improve the appearance of the house itself. You will be surprised how carefully chosen landscape products can make any house look more interesting and attractive.

Then consider the shape of your lot and the way its form will affect landscaping. In most cities there are four basic types.

The confined rectangle surrounded by neighbors offers only rigidly defined space. You must consider the view of neighbors roofs and windows and your backyard garden may be influenced by as many as five other dwellings. If the homes around you cannot get together on an inter-yard plan, be independent.

The narrow lot offers several unsuspected advantages. It can readily be zoned into "use-areas"—children's play center, work

area, patio, service center. The trick is to get the areas to flow together easily and naturally.

The corner lot may be the most difficult to design, especially when privacy is the main goal. A part of the problem is setbacks on two street-fronts. Why fight it? What you lose in private space you can gain in a feeling of space.

The pie-shaped lot can be the most desirable, especially when its narrowest point is at the street. Use your imagination to its fullest.

Essential areas. It is easier to plan a yard around the habits of your family than to try to adapt the way you live to grounds that are improperly designed. Take the time to include the kinds of areas you like and be certain there is enough room. There are nine essential centers. Few lots will include all of them, but as you decide on those you will need consider the factors mentioned.

1. Play areas. Are your children preschool? Or older? Do you need room now for a sand box and tricycle runs? Can the equipment and space be designed so that it grows as your children grow? Do you need teen-age room now—space for dances and small parties?
2. Patio areas. Will the patio join the house or be independent? Is it to be used for entertaining, play or relaxation? Should it be designed for sun, shade or both? Do you want one level or two?
3. Work center. It would be well to consider room for a work center—gardening, sculpturing, painting, even cabinetmaking. Teen-agers may want room to tinker with an old car and small fry need a place to build strange things. Should you include room for storage? What about space for clothes drying? Should the dryline be portable or permanent?
4. Recreation center. Game centers are fun places but they can eat up space. Will you want portable games? (ping-pong, for example). Or permanent games such as shuffleboard or basketball? Can the front drive be utilized for this or other games? What about room for badminton, tetherball or a putting green?
5. Storage center. A certain amount of outdoor storage is essential for any well-run garden. You will need space for mower, shovels, rakes and hoses. What about additional storage for potting mixes, compost and paints? Do you need room for ladders, lawn furniture and repair equipment?
6. Garden. If you do not like a little maintenance, forget a garden; but if you do like to putter among plants and soil, consider one or two gardens —a decorative one for flowers and utilitarian one for food. If you want to grow your own vegetables ask yourself questions about size, sunlight and species. How large should the garden be? What vegetables will you grow? Do you need poles, supports or special soils?
7. Shelters. If you are a serious gardener consider a work center, a permanent place for potting, grafting and transplanting. How big should it be? Where will it go? Should you include a greenhouse?
8. Trash center. Families accumulate trash, much of it bulky and difficult to handle. Include room—out of sight—to hold the materials between collections or trips to the dump. Where should the trash center be? How big? Can it be hidden naturally or will it require screening?
9. Water. The sight and sound of water add a special touch in any garden. Do you want a small pool, a fountain, or both? Should it be in view of the patio or set aside for discovery

▲ *Simple and effective play area is made of rough logs.*

on a pleasant walk? Do you want to include a swimming pool?

Proper planning. Put your plan on paper. You will save many hours of work if you can locate a deed map (with actual dimensions and property orientation); contour map (especially important for hilly sites); or architect's drawings (which should show the house as related to the lot). Make a large drawing—two by three feet is good—and include all the details you can. Bring out the checklist from your inventory and add the important factors.

If you are afraid to design boldly begin with "doodles," miniature designs you can expand later. Try for simplicity and order. Plan areas with recognizable shapes—familiar forms such as rectangles, squares and circles. Design generously first, then figure costs and trim later. But leave space between plantings. Remember that as plants grow the more vigorous ones may erase your design.

Preserve privacy with grids, screens and fences. Use overhead structures to block a low terrace from taller neighbors. If the timbers are laid closely you may not need cover, but when cover is required use fabric or translucent plastic. Canvas is traditional but for a different touch try burlap. It offers improved ventilation through an open weave. At eye level, build fencing and augment the structures with borders of thick, tall shrubs.

Wind can be suppressed with fences that either divert sudden gusts or trap them with louvers and screens reducing their force. A roofed area is not essential, but baffles at the top can be effective.

Use solid panels for privacy, cut-outs and embossed patterns for decoration, and glass to preserve or dramatize a view.

Choosing plants. When you block in plantings remember the "rule of three." Most plantings look best when grouped in uneven numbers. There are, of course, exceptions such as the times you use a particularly showy or interesting plant as an accent. And the rule need not apply to large trees—particularly shade trees.

The size of the plant materials, particularly when mature, is important. They should relate to the size of your home. Alongside a house, plantings should be low. A single-level, ranch-style house needs particularly low plants while a tall, two-story house needs taller ones to reduce it in height.

Keep plantings low beneath windows to insure a view. In those occasional cases where there is an objectionable view or privacy is a problem, create screening with a well placed tree or shrub kept well away from the house, or try a hedge or decorative fence also located away from windows.

Corner plantings can provide a transition between the sharpness of your house and the open space beyond. Extend your

A garden deck-shelter such as this is surprisingly easy to build and will be a source of beauty and pleasure for many years. It is constructed of redwood and pretty plastic panels.

planting well beyond the corner of the house to add an appearance of width and to avoid a "sudden stop." Use plants in a curve rather than a right angle and never use trees or shrubs at the corners that will grow higher than the eave.

Take special care with the entrance for it is there you create the greatest impression on your visitors. Select plants that say "welcome." Frame the entrance attractively, but avoid a cramped look.

Try that unusual plant at the entrance—the nice specimen that will create a focal point, if you have a large porch or entrance area, use several potted trees or shrubs. Perennials, changed seasonally, can provide vivid splashes of color.

Here are some basic rules set forth by The American Association of Nurserymen to assist you in landscaping design.

1. The heights of the plantings should be irregular, but related to the height of the house.
2. When houses are informal, plant materials in beds to provide informal, flowing lines around the home. Right

➤ *Landscape to enhance garden pools. Redwood deck, shown here, not only complements the landscape architecture but provides a private place to face the sun.*

angles and boxy gardens generally go better with older homes more formal in character.

3. Use a combination of plants to provide variety. Mix evergreens with deciduous and flowering plants. Remember the appearance of plant material changes in fall and winter.
4. Select plants by their size at maturity, not their size in the nursery. Shrubbery can be pruned, but requires time and care and the work can be eliminated with careful selection.
5. Plant at least three feet from the house and far enough from other plants to allow for growth to maturity without crowding.

If you are interested in minimal yard maintenance be sure to consider these additional points.

Select trees and shrubs that will not require pruning for foundation plantings alongside your house. Save yourself work by buying plants that will be suitable for your needs when they have reached maturity.

Use an effective ground cover around plantings to eliminate the need for weeding and to avoid mowing against the tree trunks. Mulches are the easiest and least expensive, and wood chips and ground bark are especially low-cost. Crushed stone is an attractive material for this purpose, but include a layer of plastic sheeting to prevent weeds from forcing through. If you want additional plant material, use one of several varieties of crawling ivy. You must nurture young plants to get them going, but as they begin to thrive, you can forget about maintenance.

Outline planting beds with something that will provide a definite demarcation between lawn and plantings. Brick sunk to soil level is the most effective. Cut strips of wood and narrow trenches are also good.

Your local member of The American Association of Nurserymen will be glad to recommend varieties of trees and shrubs that require the least attention. The ginkgo tree, for instance, drops its leaves rapidly in the autumn, making raking a one-time chore. The limited growth of the crabapple, the Japanese maple, and the dogwood makes them ideal for small areas, with no pruning to worry about.

To reduce your flower-growing chores, concentrate on informal gardens of wild flowers and herbs, which need only sunlight and occasional watering.

Further reduce your yard maintenance with a large patio. Innumerable designs can be made with concrete, brick, stone and gravel to offer attractive possibilities. If you are installing a fence, make sure you use a material that needs no painting and resists rot, such as redwood, red cedar, ornamental concrete blocks, or brick.

Patios. The best patios are in scale with lot, house and the recreations they support, but many people err on the side of smallness. Inside a home things relate to the enclosure but outside patio and furniture must be larger just to compete.

Even a small place may require a 300-square-foot patio to handle a picnic table, barbecue, chaise lounge and a few chairs. When space is limited a few tricks can help you make the most of it. Begin by reducing furniture and the number of activities a patio offers. Fewer activities means less congestion. Avoid glaring colors. Choose subtle tones that blend with the yard. Pave with smaller brick, tile or stone to accent comparisons. Add variety with new levels, raised planters and steps which lead the eye upward increasing the illusion of space. Use low fences to move the eyes beyond the property line.

Patio designs belong to the landscape as a whole. There are three basic designs and the concepts can be mixed or married in any way that seems relevant.

Rectangular designs are seldom wrong. The form is easily related to the house and

➤*Small pools of water can be just as effective as large ones. A simple fountain, such as this, can be economically installed to provide the visual refreshment of water in motion.*

property lines, and can be set at right angles to them. An acute angle is still considered "modern" in many circles but when space is at a premium a patio set at a 45° slant seems to create a feeling of greater space.

Freeform shapes are in vogue because they are flexible and adaptable. When the size is in proportion to the house and when lines relate to the garden, the forms are exciting. As you plan unconventional shapes begin with a rectangle then soften edges and proportions until the result seem pleasing. Avoid sharp corners (or too many of them) and never pinch lines, that is, narrow areas until the form seems unstable.

Circular designs are not as common, but can relate well in larger areas. Often circles are used within rectangle and freeforms to accent. In many cases the area is decorated with a different paving, texture or material.

Try all designs on paper first, then in your yard. Forms can be traced full-size with a garden hose to give you an idea of the feasibility. When you are in doubt, consult a qualified landscape architect. His advice and planning may cost from $100 to $1000, but the money is well spent. Professional advice eliminates errors and saves both time and money.

See also: BRICKWORK; DECKS; FLOWERING BULBS; GARDENING; GARDEN PLANNING; LIGHTING; ORNAMENTS, LAWN; PATIOS.

Using Laser Beams for Voice Transmission

The reliable and simple laser system is easy to build from a kit and an FCC license is not required

LASER, THE "PENCIL LIGHT" that surveys land, hem-stitches the human retina, offers true three-dimensional photography and many other space-age wonder achievements, is no longer a curiosity of the laboratory or an expensive industrial tool. The laser can be your experimenting tool at home at reasonable costs. You can investigate basic scientific principles—polarization, refraction, critical angle, diffraction, interference, Lloyd's mirror, Michaelson interferometer, holography, Doppler effect, and many more interesting light phenomena with your own laser.

You can even talk on a laser beam! A simple laser system can transmit voice or data communications over a distance of several hundred feet, and the line-of-sight range can be extended to several miles by the addition of beam collimating optics.

Aside from the privacy that such a system provides, there are other advantages over conventional communications methods. For one, you do not need an FCC license as you do with a CB rig. Nor do you have to pay the telephone company extra revenue for the added service. Once the laser equipment is installed, operating cost is virtually nil because the electrical power consumption of a laser communications system is very modest.

And even if you do not have a crying need for a confidential hot-line, experimenting with laser communication can be a lot of fun—especially since you would be working in an area that is on the verge of a major communications revolution. As you probably already know, laser linkages may eventually solve the problem of increasing congestion on some conventional long-distance telephone cables. Already,

lashing: see camping equipment
latches: see doors

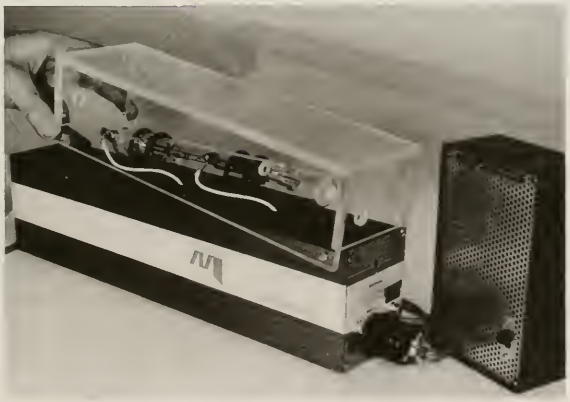
laser links are used over rough mountain areas to eliminate conventional wires. Other examples of laser communications applications that have arrived, or may do so soon, include ship-to-shore communications (vital when radio silence must be maintained, or when electrical disturbances garble radio-telephone communications), battlefield communications, law enforcement applications, and the rapid transmission of data between computers.

Kits save money. Consider building your own laser system from a kit. One manufacturer came out with a model offering a streamlined PC circuit, instruction manual, and provision for easy installation of the laser tube inside the metal housing containing the electronic circuitry. If you want to put the laser tube outside the housing so that you can watch the fascinating lasing action, make a protective shield from ¼-inch Plexiglas. It not only protects the expensive tube from physical damage, but also protects you from dangerous shocks.

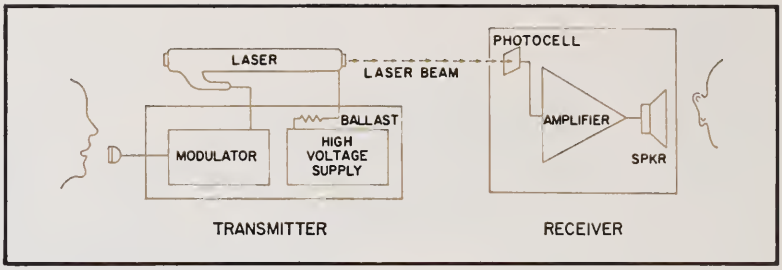
Although the equipment you might buy is not identical with the prototype equipment shown here, the differences are minor, so you can safely use this information to decide whether construction of a laser communicator is for you. Included in one kit are an MT 205 laser tube, power supply, communicator housing, a modulator kit, microphone, silicon photosensor, and a receiver. This kit is priced at about $150 and is expressly designed for voice communications. It has a bandwidth of 60 Hz to 125 KHz. If you already own a helium-neon laser, it may be suitable for use with some kits which are tagged lower. But before ordering these conversion kits, check with the manufacturer to make sure that it is compatible with the laser system you have.

A new completely assembled system for both voice and data transmission is also available. It consists of a laser and a receiver. The latter includes a microphone to complete the system. Band-width is 300 Hz to 500 KHz. This system is not available in kit form.

This or any other laser construction project is not recommended for those who have trouble putting batteries into a flashlight. The voltages in any laser power pack are lethal—1700 volts and up, depending on the unit design. But if you have experience fiddling with TV or other high-voltage equipment, the laser poses no unusual construction problems or hazards.



➤*Laser tube can be mounted on top of equipment case; lets you watch fascinating laser action. Build a Plexiglas cover for safety. Black case houses a microphone, small speaker.*



▲ *One-way laser system for voice communications. Lasers shown here are in no way hazardous to the user, as long as they are used with common sense. They are approximately as hazardous as sunlight or light of an arc-lamp projector. Take care.*

The low power laser beam cannot burn holes into anything, even if you try to intensify it with a lens. But there is potential danger to eyesight if the beam is allowed to enter the eye unattenuated or undiffused. So do not let anyone look directly into the beam, or into a beam reflected from a shiny surface. Viewing the beam from the side is perfectly safe. Just bear in mind that the laser communicator is definitely not a children's plaything.

Pick the right laser. Some laser tube designs are more suitable than other designs for communications applications. The type of information you wish to transmit—voice or computer data, for example—should be considered when making a selection.

The helium-neon laser tube, shown here in the prototype unit, offers a modulation capability for such applications as voice or data transmission. When operated with the recommended 1700-volt power supply, it provides 0.3 milliwatts of optical power at a wavelength of 6328 angstroms (wavelength of red light).

A newer communications system utilizes a laser having 15 percent modulation at maximum output (1.5 milliwatts). The input signal level is 200 mv peak-to-peak nominal, and .5v peak-to-peak maximum. If you need 100 percent modulation capability, as for data transmission rather than for voice, there are other systems made to suit these needs.

The light output from the laser tube is intensity modulated by modulating the electrical current that activates the tube. For voice modulation, the tube is biased at about 3.75 mA DC. The input is AC coupled so that a DC signal applied at the input will not affect the tube bias; however, an AC voltage at a frequency in the 60 Hz to 125 KHz range will make the current change and thereby affect the intensity of the light beam. The tube is driven with a current ranging from 2 ma to 5.5 ma. Above 5.5 ma cathode burnout would be accelerated; below 2 ma the tube becomes unstable.

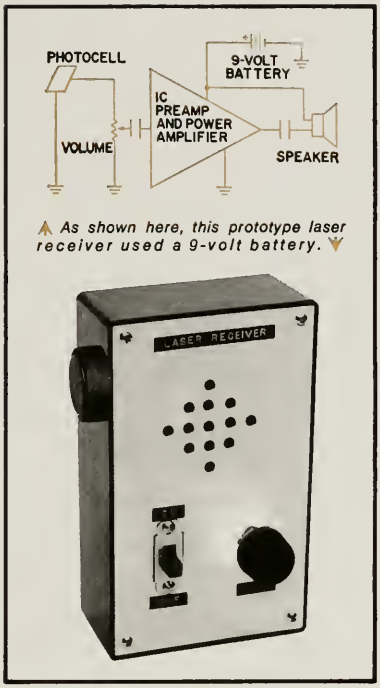
How it works. In this one-way communication system a speaker-microphone (or a crystal mike) drives a preamplifier-amplifier integrated circuit. The IC drives a low-voltage current-modulating amplifier which in turn drives a high voltage current modulating transistor; it is this transistor that modulates the current flowing through the laser tube. The modulator printed circuit board includes a rectifier-filter circuit to provide low voltage for the modulator circuit and a constant-current sub-section which maintains a minimum current in the laser tube by use of a separate high-voltage transistor.

A different receiver unit contains a photocell which senses the intensity-modulated laser light and demodulates it to a current that is directly proportional to the modulated laser light level. The resulting current signal is amplified and fed to a speaker.

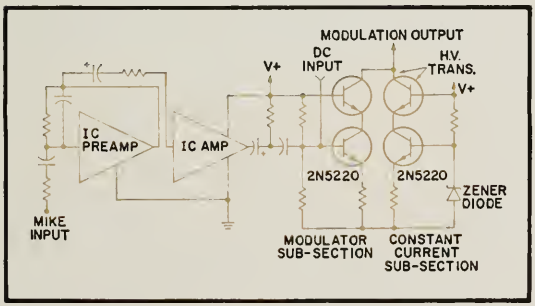
Inputs can vary. When the full amplifier section of the prototype modulator system is used, the input can be as low as 2 millivolts AC, in which case the bandwidth is limited to between 150 Hz and 10 KHz. Note the DC Input point at the base of the modulator's 2N5220 transistor. If the amplifier section is by-passed by injecting a ±3 volt input signal at this point, the bandwidth can be extended from DC to over 125 KHz, with 100 percent modulation.

The light sensor is a large area photocell which permits easy alignment and maximum light-gathering capability. The cell's upper frequency response is limited to about 25 KHz (2 db down). However, frequencies approaching 1 MHz can be sensed by substituting a higher frequency sensor such as a photo transistor or small area photo diode.

The speaker-microphone shown is equipped with a volume control and a push-to-talk slide switch. An 8-prong plug (only four contacts are used in the one-way system) plugs into a receptacle at one end of the laser tube housing. The housing also has two extra jacks. One provides a connection with the DC Input already mentioned; the other provides an input point for such signal sources as a tape re-



As shown here, this prototype laser receiver used a 9-volt battery.



Solid-state laser modulator. Transistors, at right, maintain constant current through laser tube. This allows lasing action during periods of no modulation. Remaining transistors vary current in proportion to mike input signal, to change intensity of beam.

corder, signal generator, or a crystal microphone which could be used in lieu of the speaker-mike for improved speech quality.

Performance. Divergence of the smaller laser beam is 0.8 mRad and the beam diameter spreads from 1 mm near the tube field to 8 mm at a distance of 30 feet. Transmission up to 100 feet is feasible without use of accessory equipment.

The laser used in the new communicator system has a beam divergence of 1.0 mRad, but since the power output is higher (0.7 mw compared to 0.3 mw for the equipment shown), you should have no trouble communicating over distances well over 100 feet without optical collimating. The manufacturer says that an eight power collimator will boost the working distance up to 1,500 feet, and that a twenty power collimator will permit communication up to a distance of 2,500 feet. If you pass the beam through a 4½-inch Palomar type reflecting telescope, the range can be increased to several miles!

If there is a physical obstruction such as a tree or building between the transmitter and receiver, small mirrors can be used to bend the beam around obstructions. Where the beam might be obstructed by passing people or animals, mirrors can be used to elevate the beam to a height that would prevent such interference, and safeguard the eyes of people who do not know the beam is there.

Certain atmospheric conditions (snow, sleet, rain and heavy fog) hamper laser communication. Atmospheric temperature variations can also cause the beam to wander off the receiver target; however, such beam wandering can be minimized by use of a simple, large lens.

On the Beam. The best time to line up the transmitter and receiver is at night when the red spot is easy to see. In the daytime, locate the distant spot by keeping it on a cardboard as you walk from the transmitter toward the receiver position. If you wish to use the communicator in other than a single, fixed position during the daytime—and especially over rough terrain where tracking the beam with a cardboard screen would be impossible—consider adding a sighting scope of the type used to put astronomic telescopes on target. Calibrate the scope at night for various distances up to the range of the communicator J.H.

See also: COMMUNICATIONS; ELECTRONICS; SCIENCE PROJECTS.